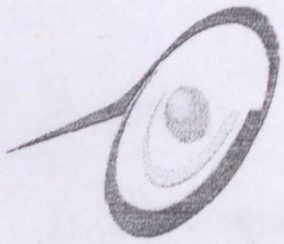


UNIVERSITY OF MALAYA

FACULTY OF
COMPUTER SCIENCE
&
INFORMATION TECHNOLOGY

PERSONAL LIBRARY & INDXING MANAGEMENT INFORMATION SYSTEM (PLIMIS)

Designed by :

Choong Wai Kit (WEK 98029)

Supervised by :

Mr. Teh Kang Hai

Moderated by :

Raja Noor Ainon Zabariah Raja

Zainal Abidin (Prof. Madya)

TABLE OF CONTENTS

ABSTRACT

The Personal Library and Indexing Management Information System (PLIMIS) is an information system used to organize and manage a personal collections of reading materials such as books, journals, journal articles, magazines, articles, dictionaries and CD-ROMs. The system allows easy searching and retrieving of the items in the collections as it adopts a systematic classification and indexing for the reading materials. This will save the time in searching a specific item.

PLIMIS is designed for personal use and contains most of the features in the current library information system. It provides user friendly interface and help to the user for easy using and understanding.

The system is divided into two modes, administrator mode and user mode. The administrator is allowed to add or delete the information of reading materials and also add or delete users in the database. The users are authorized people who can search and retrieve data from the system after a successful login.

Title indexing is used for searching and retrieving of records. The Dewey Decimal Classification with author indexing are used for arranging and placing of reading materials on the shelves for easy finding. The searching methods which can be used are by title, subject and author. All the related reading materials will be displayed for the user in a sorted form.

The methodology of developing PLIMIS is based on the software prototyping model. This system will be developed using Microsoft Visual Basic 6.0, Microsoft Access 97 as its database and Seagate Crystal Report 7 to generate report.

ACKNOWLEDGEMENT

First of all, I would like to take this opportunity to thank my supervisor, Mr. Teh Kang Hai for his comments and meticulous supervision through the lengthy process in the development of the first part of this project.

Next, my gratitude goes to my moderator, Puan Raja Noor Ainon Zabariah Raja Zainal Abidin for her advice and comments. I also would like to thank my friends who have helped and guided me.

Last but not least, I would like to thank everyone either directly or indirectly who have provided me their help.

List of Figures

List of Tables

CHAPTER 1

INTRODUCTION

1.1 Introduction

Today, the world is in the Information Technology age with computers becoming increasingly popular. No matter where you are, computers are used widely to simplify tasks. For example, salaries, wages or fees are processed by computers. Even the bank statements and demand for payments might also generated by computers. Computers seem to leave their marks everywhere starting from space projects to the latest rate demands. In fact, the world has reached a stage where everything seems to be computerized or is going on the computer, and its influence seems inescapable. The main reason for the wide use of computers is because of its accuracy and efficiency. Computers can process thousand or million of data in just a few seconds.

At present, most of the libraries are computerized because of the need to manage the fast increase in reading materials. With the large amount of books, the old catalogue card system is not efficient. Therefore, information systems are set up in the libraries for fast searching of information and managing reading materials. With this facility, all the reading materials are well organized and placed in a manageable order. The users or librarians can search their books easily because of the good classification and indexing systems.

Today, many people also have their own collections of books and reading materials. Sometimes there is a problem for a person to find a specific book due to the large number of items in the personal collections. This will waste a lot of time in finding a single book. With the popularity of personal computers (PCs), the problem is solved by developing a mini library information system. This research will focus

on the development of such an information system, called Personal Library and Indexing Management Information System (PLIMIS).

The function of PLIMIS will contain most of the features in the present library information system.

1.2 Objective

This information system is specially designed for home users to manage their reading materials like books, journals, journal articles, magazines, articles, dictionaries, CD-ROMs and etc. It also provides a classification and indexing system to arrange all the reading materials in a systematic order for fast finding.

The objectives of PLIMIS are listed below :

a) Easy Searching and Retrieving

All the information of reading materials like title, author's name, publisher and year of publishing are entered into the system, therefore the information of a specific book can be easily retrieved.

b) Systematic Classification and Indexing

The reading materials are divided into different categories and indexed by the system for reference, systematic arrangement and easy finding.

c) Time Saving

With the searching and retrieving feature, all the relevant books information can be found quickly.

1.3 Scope

The scopes of this project are listed below :

a) Security Login

This system is designed for personal usage only, therefore authorized users are provided with an individual user ID and password. The users need to enter their ID and password before accessing the data in the database.

b) Data Entry

Only the administrator is allowed to add, modify or delete the information of reading materials in the system.

c) Record Searching and Retrieving

Users can search the records in the system by using the title searching, subject searching, author searching or keyword searching methods. All the related records will be displayed in a sorted order for the users.

d) User Setup

Only the administrator has the right to add or delete users. The users only can change their password.

e) Audit Trail

The system will record what the users have accessed, login and logout date and time.

1.4 Project Schedule

ID	WBS	Task Name	Duration	Start	Finish
1	1	**Semester I**	**65 days**	**Mon 12-06-00**	**Fri 08-09-00**
2	1.1	Introduction	10 days	Mon 12-06-00	Fri 23-06-00
3	1.2	Literature Review	20 days	Mon 26-06-00	Fri 21-07-00
4	1.3	System Analysis & Dsign	30 days	Mon 17-07-00	Fri 25-08-00
5	1.4	Documentation	65 days	Mon 12-06-00	Fri 08-09-00
6					
7	2	**Semester II**	**70 days**	**Mon 30-10-00**	**Fri 02-02-01**
8	2.1	Coding	45 days	Mon 30-10-00	Fri 29-12-00
9	2.2	Testing	25 days	Mon 11-12-00	Fri 12-01-01
10	2.3	Implementation & Evaluation	5 days	Mon 15-01-01	Fri 19-01-01
11	2.4	Training	5 days	Mon 22-01-01	Fri 26-01-01
12	2.5	Documentation	60 days	Mon 13-11-00	Fri 02-02-01

1.5 Hardware and Software Requirements

PLIMIS is specially designed for home and personal use, therefore the system can store information on about 3,000 books or other reading materials. With the above features, the requirements of PLIMIS are listed below :

a) Hardware Requirements

i) 486DX/66 MHz or higher processor (Pentium or higher processor recommended), or any Alpha processor running Microsoft Windows NT Workstation.

ii) 16 MB of RAM for Windows 95, 32 MB of RAM for Windows NT Workstation.

iii) At least 30 MB of available disk space.

iv) VGA 640x480 or higher-resolution screen supported by Microsoft Windows.

v) A CD-ROM disc drive.

vi) A mouse or other suitable pointing device.

b) Software Requirements

i) Microsoft Windows 95 or later, or Microsoft Windows NT Workstation 4.0 (Service Pack 3 recommended) or later.

ii) Microsoft Access 97

iii) Microsoft Visual Basic 6.0

1.6 Overview of the Chapters

Chapter I – Introduction

This chapter consists of the introduction to library information system, objectives, scopes, hardware and software requirements of the project.

Chapter II – Literature Review

The literature review covers the definition of the Personal Library and Indexing Information System (PLIMIS), online retrieval system, classification and indexing methods. This chapter also contains some searching methods and a summary.

Chapter III – System Analysis and Design

This chapter covers the analysis phase of the project, such as the user requirements, functional requirements and non-functional requirements of the system. The design phase in this chapter includes system design, database design, program design and user interface design.

Chapter IV – Coding

In this chapter, the coding tools, coding approach, internal and external documentation and the coding specification are discussed.

Chapter V – Testing

This chapter covers the purpose of testing, unit testing, integration testing, testing planning and system testing process.

Chapter VI – System Evaluation

This chapter will discuss the strengths, limitations, problems and solutions, future enhancements for the system and the conclusion of the project.

CHAPTER II

LITERATURE REVIEW

2.1 Definition

Personal Library and Indexing Management Information System (PLIMIS) can be split into shorter phrases and explained as :

Personal Library : A private or individual room or set of rooms where books and other literary materials are kept [1].

Indexing : A systematic list of book titles or author's names, giving cross-references and the location of each book; catalogue [1].

Management Information System : A Management Information System (MIS) is a system for providing information and information processing to support organizational activities, competitive strategy, and management functions. The system utilizes information technology; manual procedures; models for analysis, planing, control, and decision making; and databases. The portfolio of MIS applications covers a wide variety of organizational needs, including applications that indirectly support management activities and applications that directly serve management users. Since management applications frequently need data that is best provided by a database, databases and database management software are generally part of a MIS [2].

2.2 Online Information Retrieval System

An online information retrieval system is a set of computer hardware and computer software for retrieving information from databases. Computer hardware is the physical equipment of the computer system, such as computer itself, various storage devices, and terminals. Computer software is the group of programs and procedures that act as instructions to the computer system [3].

Information retrieval is concerned with the representation, storage, organization, and accessing of information items. In principle no restriction is placed on the type of item handled in information retrieval. In actuality, many of the items found in ordinary retrieval are characterized by an emphasis on narrative information. Such narrative information must be analyzed to determine the information content and to assess the role each item may play in satisfying the information needs of the system users. The items processed by a retrieval system typically include letters, documents of all kinds, newspaper articles, books, medical summaries, research articles, and so no [4].

The purpose of Information Retrieval is simply to obtain relevant answer to questions. In the modern world, however, both the amount of information, and the rate of its increase, are so enormous that this 'simple' aim presents major problems. The 'information explosion' has been graphically described by a number of authors, and we will not dwell on it, save to observe that the increasing difficulty of coping with this flood of information has prompted librarians and information scientists to turn to the computer as a possible means of containing the problem [5].

2.3 Database Procedures

Database procedures are the organizations that collect the information, select appropriate documents or other items for inclusion in the database, and convert the material into computer-readable form. The database procedures analyze the documents, extract important information such as the author, title, and source of publication (for bibliographic databases), and may augment the extracted information with additional information such as index terms, abstracts, language codes, or chemical structures [3].

2.4 Information System Types

Information retrieval exhibits similarities to many other areas of information processing. The most important computer-based information systems today are the management information system (MIS), database management systems (DBMS), decision support systems (DSS), question-answering systems (QA), as well as information retrieval system (IR) [4].

a) Information Retrieval Systems

Information retrieval is best understood if one remembers that the information being processed consists of documents. In that context, information retrieval deals with the presentation, storage, and access to documents or representatives of documents. The input information is likely to include the natural language text of the documents or of document excerpts and abstracts. The output of an information retrieval system in response to a search request consists of sets of

references. These references are intended to provide the system users with information about items of potential interest [4].

b) Database Management Systems

Any automated information system is based on a collection of stored items (a database) that needs to be accessed. Thus database management systems might simply be systems designed to manipulate and maintain control of any database. In actual practice, database management systems are concerned with the storage, maintenance, and retrieval of data facts available in the system in explicit form. That is, the information does not appear as natural language text but is available instead in the form of specific data elements stored in tables. In a database environment each item, or record, is thus separated into several fields, and each field contains the value for a specific characteristic or attribute identifying the corresponding record [4].

c) Management Information Systems

A management information system is a database management system tailored to the needs of managers. The functions performed by a manager in a given corporation depend on the availability of many kinds of data. Of particular interest may be information leading to the choice of possible alternatives by the manager presented in terms of ranges of values of particular attributes. A management information system therefore fits the general database management framework. However, in order to be useful to the manager, the information may be subjected to special processing not normally available in database

management systems. For example, a database of geothermal dispersion data may be used by a manager to determine the effect of differing equipment configurations in a plant. In such case, data relating to particular equipment configurations and to dispersion characteristics would be connected to a modeling capability to support the manager's activities. Such special-purpose systems useful for management are known as management information systems [4].

d) Decision Support Systems

The systems described so far perform specific operations on homogeneous classes of information items. Normally, information retrieval systems do not perform management information functions, and vice versa. However, it is in principle possible to conceive of information systems in which a variety of different components are assembled into a single cooperating structure that includes information retrieval systems, database management systems, computer graphics systems, and other technical capabilities which collectively provide powerful tools in support of the decision making process [4].

e) Question-Answering Systems

Questing-answering systems provide access to factual information in a natural language setting. The stored database often consists of large numbers of facts relating to special areas of discourse, together with general world knowledge covering the context within which conversations between persons usually take place. User questions may be received in natural language form, and system

responses may also be furnished as natural language formulations. The task of the question-answering system consists in analyzing the user query, comparing the analyzed query with the stored knowledge, and assembling a suitable response from the apparently relevant facts [4].

2.5 Classification and Indexing

Some books on information retrieval by computer seem to use the terms 'indexing' and 'classification' indiscriminately, as though the two are synonymous. There is indeed a great deal of similarity in the methods used in these processes. It seems more useful to distinguish between them and to show that, however they may be carried out, the two ideas are different in intention [5].

a) What is classification ?

The primary purpose of classification is to decide where to put a given document or object. Classification schemes are not only used for libraries, but also for museums, art galleries, or any large collections of objects which are to be stored or displayed. In a library documents are arranged in a carefully work out order, so that related subjects are close together on the shelves. Of course a knowledge of the classification scheme will tell a user where to look for the information he requires, but if he is not familiar with its organization, he will not know where to start looking. The immediate purpose of classification is thus to organize the storage of information, not its retrieval [5].

b) What is indexing ?

The purpose of indexing is to facilitate the finding of information. Thus the indexing of a collection of documents entails identifying the most important topics (or attributes) dealt with in each document, and arranging these attributes into an alphabetical list, so that a user can look up to find documents of interest to him [5].

Indexes vary greatly both in a scope and precision. By 'scope' we mean the set of objects or documents covered by the index, and by 'precision' we mean the exactness of the references the index gives us. Thus, one index may cover a whole library, but may only specify which class-number to look at : this is an index to the classification scheme. Another index may cover a particular section of a library (e.g. Nuclear Physics), and specify which books to read. A third index may cover a particular journal, and specify which individual papers to consult. A well-known type of index covers a particular book, and specifies which pages to look at. It is generally but not absolutely true that the smaller the scope of an index, the more precise are its references [5].

2.51 The Five Major General Classification Schemes

1. The Dewey Decimal Classification (DC)

The first modest edition of the Dewey Decimal Classification, consisting in total of only 42 pages, appeared in 1876. In 1989 the 20th edition was published in four volumes : Volume 1 the introduction and auxiliary tables; Volume 2 and 3 the schedules; and Volume 4 the index with – for the first time – a manual of practice [6].

The first edition of DC established the basic structure and the principles upon which it was to develop. DC regards knowledge as unity which is to be divided into nine large classes with a tenth general class [6].

Table 2.11 Dewey Decimal Classification

0	General works
1	Philosophy and psychology
2	Religion
3	Social sciences
4	Philology
5	Natural sciences and mathematics
6	Technology
7	The Arts
8	Literature and rhetoric
9	Geography and History

Each of these classes is further broken down into nine divisions, for example [6] :

Table 2.12 Dewey Decimal Classification

300	Social sciences
310	General statistics
320	Political science
330	Economics
340	Law
350	Public administration
360	Social services
370	Education
380	Commerce
390	Customs, etiquette, folklore

These divisions are, thereafter, further subdivided into nine sections, for example:

Table 2.13 Dewey Decimal Classification

324	The political process
324.2	Political parties
3324.22	Leadership
etc.	

In this manner, DC uses its decimal notation to display the hierarchy of subjects. This is a desirable and but leads to anomalies in the practical development of the schedules, in that options are restricted to nine places at each stage of division and if a concept has more than nine equal subdivisions, then the hierarchy breaks down. The notation is simple and purely numeric, which has limitations but enhances DC's international appeal [6].

2. The Library of Congress Classification (LC)

The Library of Congress was set up in 1800 to provide a reference collection for the government of the United States in Washington. By 1870, ensuring that copyright deposit was strictly adhered to, the then librarian Ainsworth Rand Spofford was supervising the enormous growth of the collection and its metamorphosis into a true national rather than governmental library [6].

The scheme is arranged first into main classes and their subclasses, where appropriate, and schedules for these are produced in groupings [6] :

Table 2.21 Library of Congress Classification

Classes and Subclasses		Schedules published	
A	General, Polygraphy	A	General, Polygraphy
B-BJ	Philosophy, Psychology	B-BJ	Philosophy, Psychology
BL-BX	Religion	BL-BX	Religion
C-F	History	C	Auxiliary History
		D	History-Ancient / Eastern
		E-F	History-American
G-GE	Geography	G	Geography / Anthropology
GF-GN	Anthropology		
HA	Statistics	H	Social Science
HB-HJ	Economics		
HM-HX	Sociology		
J	Political Science	J	Political Science
K	Law	KD	Law-United Kingdom
		KF	Law-United States
L	Education	L	Education
M	Music	M	Music
N	Fine Arts	N	Fine Arts
P	Language and Literature	P-PA	Linguistics, Classical languages and literatures
		PB-PH	Modern European Languages
		PG	Russian
		PJ-PM	Other languages
		PN,PR,PS, PZ	English Literature
		PQ1	French Literature
		PQ2	Italian, Spanish, Portuguese Literature

		PT1	German Literature
		PT2	Dutch / Scandinavian Literatures
Q	Science	Q	Science
QA	Mathematics		
QB	Astronomy		
QC	Physics		
QD	Chemistry		
QE	Geology		
QH	Biology / cytology		
QK	Botany		
QL	Zoology		
QM	Human Anatomy		
QP	Physiology		
QR	Bacteriology / Microbiology		
R	Medicine	R	Medicine
S	Agriculture	S	Agriculture
T	Technology	T	Technology
U	Military Science	U	Military Science
V	Naval Science	V	
Z	Bibliography, Library Science	Z	Bibliography, Library Science

Each of the classes is further subdivided into its main divisions, for example in Class L, Education, we have [6] :

Table 2.22 Library of Congress Classification

L	Education (General)
LA	History of Education
LB	Theory and Practice of Education

LC	Special Aspects of Education
LD-LG	Individual Institutions LD United States LE America (Non-US) LF Europe LG Asia, Africa, Oceania
LH	College and School Magazines and Papers
LJ	Student Fraternities and Societies, United States
LT	Textbooks

3. The Universal Decimal Classification (UDC)

Of the three most popular general classification schemes UDC is the one aimed specifically at retrieval of information by subject rather than at the achievement of a helpful shelf arrangement. It is also the most synthetic and plans are afoot which may mean that the synthetic elements of UDC are developed considerably in future [6].

UDC was designed as a practical classification scheme, by Paul Otlet and Henri La Fontaine, to provide a subject arrangement for a vast card catalogue of bibliographies covering all literature published throughout the world. UDC is chiefly bibliographic, for the detailed indexing and description of documents. In addition to expanding upon the enumeration of subjects, UDC developed considerable synthetic qualities. In the Introduction to the International Medium Edition of 1985, UDC acknowledges itself to be a 'hybrid' of the enumerative approach in the Main Tables, where the primary notation for subjects is listed, and of the analytico-synthetic elements which are available via the use of the Auxiliary Tables. We will later examine the synthetic aspects of UDC, but let us

look first at the basic structure of its schedules, as the major divisions are enumerated in UDC's Main Tables. At the first stage of division the universe of knowledge is arranged thus [6] :

Table 2.31 Universal Decimal Classification

0	Generalities Science and knowledge Organization Information
1	Philosophy Psychology
2	Religion Theology
3	Social sciences Law Government
4	(Vacant)
5	Mathematics Natural Sciences
6	Applied Sciences Medicine Technology
7	Arts Recreation Leisure Sport
8	Language Linguistics Literature
9	Geography Biography

	History

This is an arrangement very little changed from DC, apart from DC, apart from the bringing together of language and literature in 8. Again in the same manner as DC, notation is decimal and expresses the subject's rank in the hierarchy of subjects. The classes have, however, developed quite independently and the extent of detail provided is much greater in UDC than in the equivalent DC classes. In addition, main class order is not of major significance as the UDC is infrequently seen in its entirety to classify large collections. If we consider an earlier example, domestic architecture, from DC we may recall that there was a limited differentiation of types of housing. In UDC we find [6] :

Table 2.32 Universal Decimal Classification

728.1	Housing and dwellings
.2	Multi-family dwellings
.22	Blocks of flats
.222	Tenement blocks
.224	Smaller blocks
.3	Single family dwellings
.31	Terraced houses
.34	Semi-detached houses
.37	Detached houses
.38	Bungalows

Locating subjects in the Main Schedules in UDC differs very little from the process in DC, it is really in the extent of the availability of synthetic devices to add to that basic number that UDC forges ahead of its progenitor [6].

4. The Colon Classification (CC)

Most subjects can be seen as compounds. They draw their elements from the facets of a single subject field with, perhaps, the addition of common elements for space and time. CC enumerates broad conventional subject area and then within each lists elements which can be combined as necessary. Citation order is controlled by means of facet formula, for Ranganathan argued that all elements relate to one or another of five fundamental concepts : Personality, Matter, Energy, Space and Time. In citation the categories present are represented in this order, often written as PMEST. Each of the facets is introduced by punctuation marks, serving as facet indicators, which identify the notation and the facet to which it belongs. Thus, in CC, a comma heralds Personality. Matter is prefixed by a semicolon and energy by a colon (originally the only punctuation used and hence the name of the scheme). Space is introduced by a full stop and Time by the apostrophe. Time and Space are self-explanatory facets but the others are more abstruse and require some clarification. The Energy facet is used to represent processes, activities or operations which consume mental or physical effort. Matter, used comparatively rarely until the seventh edition, covers materials. Personality is best expressed as the core or root element found in most specific subjects. These ideas are best illustrated and examined by means of examples [6].

Table 2.41 Colon Classification

Example A	
(from Class X Economics)	
Subject	Economics in the USA

Verbal concept analysis	Economics / USA
Facets present	Space only (since economics is a main class)
Classmark	X.73
Comment	A simple example

Table 2.42 Colon Classification

Example B	
(from Class S Psychology)	
Subject	The anxieties of the old
Verbal concept analysis	The aged / anxieties
Facets present	Personality (P) and Matter (M)
Classmark	S,38;56[22]
Comment	In earlier editions anxieties would indubitably have been assigned to the Energy (E) facet.

Table 2.43 Colon Classification

Example C	
(from Class Y Sociology)	
Subject	Prevention of poverty
Verbal concept analysis	Poverty / prevention
Facets present	Matter (M) and Energy (E)
Classmark	Y;435:5
Comment	'Poverty' used to be in Energy (E). Like the first example this one shows that (P) is not always present.

Table 2.44 Colon Classification

Example D	
(from class 2 Library Science)	
Subject	Administration of manuscript collections in British academic libraries today
Verbal concept analysis	Academic libraries / manuscripts / administration / Britain / 1990s
Facets present	(P) (M) (E) (S) (T)
Classmark	2,3;12:8.56'N6
Comment	A rare example of all five facets being present.

Table 2.45 Colon Classification

Example E	
(from Class V Political Science)	
Subject	The work of the British Prime Minister
Verbal concept analysis	British Politics / Prime Minister
Facets present	Personality twice – hence two levels of Personality. (P1) (P2)
Classmark	V,56,21
Comment	An example of successive levels of Personality

Table 2.46 Colon Classification

Example F	
(from Class L Medicine)	
Subject	X-ray therapy of tuberculosis of the lungs
Verbal concept analysis	Lungs / tuberculosis / therapeutics / X-rays
Facets present	(P) (M) (E) (2P)

Classmark	L,45;421 :6253

It will be noted that what constitutes (P), (M) and (E) varies according to the 'raw material' of each class. It has also varied from edition to edition. The distinction between Rounds and Levels is really simply to enable us to cope with certain specific items, fortunately few, which offer more than one manifestation of a particular facet, and at the same time to preserve the most helpful citation order [6].

5. The Bibliographic Classification

H. E. Bliss laid the foundations of his work in two large tomes. These seek to establish the credentials for the classification which was to come and also recognize that reconstruction must be preceded by some demolition. The organization of knowledge and the system of the sciences concerns the structure of knowledge, showing his considerable debt to the ideas of the scientists and philosophers. The organization of knowledge in libraries published in 1933 discusses the principles of bibliographic classification, notation and what he saw as the faults of existing systems. His thoughts can be traced back at least as far as 1910 and yet BC (or BC1 as we should now call it, as there is a considerably revised BC2) was not completed until 1953 [6].

Table 2.51 Bibliographic Classification

BC outline structure			
2	Generalia	I	Psychology
3	Phenomena	J	Education

	multidisciplinary topics		
6	Universal of knowledge	K	Society
7	Information Science	LA	Area studies
A	Philosophy and logic	LB	Geography
AM	Mathematics	LC	Travel
AY	Natural Sciences	LD	History
B	Physics	P	Religion
C	Chemistry	Q	Social welfare
D	Astronomy	R	Politics
DH	Earth sciences	S	Law
E	Biological science	T	Economics & management
GY	Ecology	U / V	Technology & useful arts
H	Human sciences and studies	W	Fine arts
HA	Human biology & anthropology	X	Philology
HH	Health and medicine		

It should always be borne in mind that detailed classification is optional in BC. Some examples may serve to illustrate the character and potential of BC2. The verbal concept analysis, crucial to all classifying, forms a vital part of these. For any theme with more than one facet, concepts must be identified, then put into BC citation order before the notational chain of linkage can be applied. Incidentally notational gaps may be made after each facet, as shown here, or after every three symbols. Either method, consistently applied, is permissible [6].

Table 2.52 Bibliographic Classification

Example A	
(from Class K Society)	
Subject	Depressed areas and the problems of local

	handicapped people
Verbal concept analysis	The handicapped; depressed areas
Notational chain	KOBL Handicapped; KANV depressed region
Classmark	KOBL ANV
Comment	A simple example showing retroactive notation in Operation

Table 2.53 Bibliographic Classification

Example B	
(from Class P Religion and Ethics)	
Subject	Pentecostal Hymns
Verbal concept analysis	Pentecostal Church; hymnology
Notational chain	PUXPE The Pentecostal Church PDXL hymnology
Classmark	PUXPE DXL (or expressed alternatively PUX PED XL)

2.52 Classification Principles and Their Application to Pre-coordinate Index and Thesaurus Construction

This has been necessarily a very brief examination of the principles of post-coordinate indexing. In the present work what is of greater interest to us is the way in which classificatory principles have been applied to their creation. Let us now consider these principles as they as they are found in traditional, pre-coordinate indexes in order to control and render more effective the process of subject retrieval. Pre-coordinate indexes, as has been noted elsewhere, replicate the problems associated with classification in general, by forming a fixed order of citation of elements, but they perform an additional function in that they will support the

classification and should draw attention to the alternative locations of a topic in the various disciplines as found in the classification. Before considering pre-coordinate indexing methods we may begin by examining the way in which effectiveness can be measured in subject retrieval. Recall and precision are the two most commonly applied measures and it would be useful for us to pause and define these before considering further methods of indexing [6].

a) Subject Indexes

Any index in which a user can look up the names of topics in which he is interested may be termed a subject index. However, the type most commonly encountered is perhaps the 'back-of-book' index, whose scope is a single book and whose output consists of a set of page numbers. This type of index will be used here to exemplify subject indexes in general [5].

A back-of-book index often seems unsatisfactory to the user, one of the main reasons for this being the variability of terminology in many fields. The person preparing the index (who may or may not be the author himself) will tend to select index-terms which appear in the text, and these may not always be the terms which a particular searcher would normally use. To find what he wants, the searcher may have to guess at likely index terms [5].

b) Title Indexing

Title indexes using techniques such as KWIC (Keyword in Context) automatically generated entries from the titles of documents. These are useful for allowing economy of effort and can be effective when they deal with descriptive article titles, but often non-descriptive titles have to be enhanced by the addition

of extra subject terms or unsought terms may have to be suppressed and so the process becomes less of a mechanical one. It is, however, a relatively speedy and largely non-intellectual process. The terms used are also likely to represent current usage and terminology, although there will be no consistency overall and all synonyms will have to be sought individually by the searcher [6].

c) Keyword-from-Title-indexes (Permutation Indexes)

Keyword indexes are normally generated from a brief and informative part of the document, namely the title. The basic technique dates back more than a hundred years, but data-processing equipment was first used by H. P. Luhn (1960) who coined the term KWIC index, which stands for Key-Word In Context [5].

In preparing a keyword index by computer the basic unit of data is the title of a document or paper accompanied by its reference. The author or authors may also be included in this 'bibliographic record' to enable an author index to be compiled at the same time. Entries for the keyword index are generated by examining the titles word-by-word, in the following way [5] :

(1) Inspect first word of title

(2) If this word is not a keyword, jump to (4)

(3) Generate index entry, containing index-word with its context, and the reference to the document

(4) If there are no more words in title, jump to (6)

(5) Inspect next word in title; jump to (2)

(6) If there are no more record to read, jump to (8)

(7) Read next bibliographic record; jump to (1)

(8) Order new index entries, merge with exiting index (if any) and print out.

Terminate

The number of different keywords which might occur in a collection of documents is very large. Moreover it is hardly possible to foresee all of the possible keywords, particularly in new or rapidly expanding fields of knowledge. Thus specifying the keywords individually is not a satisfactory method, and a 'negative selection' approach is used instead [5].

d) Derivative and Assignment Indexes

Keyword index is produced by selecting words from the text, partial text or title of a document, therefore the only words which appear as index-words are derived directly from the indexed text, and so the preparation of keyword indexes is referred to as derivative indexing [5].

e) Author Indexes

The bibliographic records from which a keyword index is produced usually contain the authors of documents, as well as titles and references. This allows the automatic generation of an author index. A person who specializes in a given area of study is likely to know of several workers who are currently active in the same field, and whose names he can use as search clues. However, in an index of recent publications produced once or twice a month, the likelihood of a given name appearing in one issue of the index may be rather small. For this reason cumulative author indexes, covering particular journals for one or more years, are relatively more useful [5].

f) Citation Indexing

Citation indexes, again automatically generated, provide an alternative to the subject analysis of documents for information retrieval. Instead they bring together documents by linking citations or references. If work A has cited work S then citation indexes assume that there is a subject relationship between documents A and S. On consulting a citation index under the author of a known relevant work, one can identify all of the other documents which have cited that work and which are therefore, it is assumed, likely to have developed the subject of the original work. This is an interesting approach and research has shown that citation indexes will reveal relevant subject information not revealed by conventional indexes. They are particularly useful in a subject search where a key author or paper has been identified. Again no intellectual effort is involved in their compilation, but they depend upon their central thesis that subject relationship is central to citation and there are many instances in which this may not be the case [6].

Such system differ from those developed for use in online subject access, as they were intended for the computer generation of printed indexes and, therefore, because of the physical format in which they were to appear, necessarily had to limit the number of entries to be made [6].

Most papers and serious textbooks will contain references to earlier publications in the same or related fields : these are often known as citations. Thus, given one document, we can trace back to its 'predecessors'. Th citation lists of a number of documents may be represented as follows [5]:

DOCUMENT 1 CITES : DOCUMENTS 71, 232, 444, 450, 679;

DOCUMENT 2 CITES : DOCUMENTS 17, 119, 240, 469, 668, 707, 770;

DOCUMENT 3 CITES : DOCUMENTS 1, 91, 119, 650;

DOCUMENT 4 CITES : DOCUMENTS 184, 232, 270, 450, 505, 679, 707;

and so on.

Each citation list may be thought of as a direct record, i.e., a list of some the attributes of a particular document [5].

g) Chain Indexing

One indexing method, which explores this approach extensively, is chain indexing, a system designed by Ranganathan, where for each item included in a collection a series of entries are made in a subject index corresponding to the several stages of division in the classificatory process. In the example above the process of classifying acupuncture would have revealed several stages [6] :

Table 2.61 Chain Indexing

Medicine	610
Therapeutics	615.5
Specific therapies	615.8
Other therapies	615.89
Acupuncture	615.892

At each stage one would consider the significance of the concept introduced as the verbal equivalent of the last digit. Some of the above have no subject meaning, such as 'Other therapies', which would therefore be ignored in constructing the index. Synonyms would be sought for all of the terms, which it

was felt should be included in the index and the result would be a number of entries, eventually filed alphabetically [6] :

Table 2.62 Chain Indexing

Acupuncture : Therapeutics : Medicine	615.892
Acupuncture : Holistic medicine : Medicine	615.892
Therapeutics : Medicine	615.5
Holistic medicine : Medicine	615.5
Alternative medicine : Medicine	615.5 (synonymous term)

h) SLIC (Selective Listing In Combination) Indexing

SLIC indexing identifies all the possible subject combinations in a document and produces as headings or entries a selection of these, eliminating those already found in a large grouping, which will form part of a list or index locating documents on that subject. If we have a document on the subject of the welding of aluminium cans, then we may find that our classification scheme has grouped all information on cans together on the shelves, but that information on their welding is subordinate, as is the material, aluminium. If the enquirer seeks to locate material on the welding of other kinds of aluminium objects then the search becomes a very scattered one and the advantages of browsing the classified shelves are almost non-existent. With a SLIC index, if we assume a document exists in the library on the welding of aluminium cans, then for that document a number of entries will have been created in the index. The subject will have been analyzed into its component elements and combined in the variety of ways possible for its specification. We have here three concepts – aluminium,

welding and cans – and they might be combined by the enquirer in any one of a number ways [6] :

Table 2.71 SLIC Indexing

Potential entries A-Z index
Aluminium
Aluminium : welding
Aluminium cans
Aluminium cans : welding
Aluminium : welding : cans
Cans
Cans : aluminium
Cans : aluminium : welding
Cans : welding
Cans : welding : aluminium
Welding
Welding : aluminium
Welding : aluminium : cans
Welding : cans
Welding : cans : aluminium

This is, potentially, a very unwieldy number of entries to create for a single document in an index, although as the index grows such entries need only be made once, standing for all of the documents on that subject, and of course there are likely to be a large number of documents for a subject such as 'welding'. The problems multiply exponentially as the number of concepts represented in a document grows : where we have five concepts there would be 120 entries if these were permuted as we have shown above. Finally, SLIC is designed as an index of combinations rather than permutations in preferred order, that is

alphabetical A/Z order, so that composites can easily be found by the user. In such an index a citation order is needed and it may be alphabetical or it might be some subject significant citation order such as we are familiar with in classification. There is then no need for an entry such as 'welding aluminium' for this is not in alphabetical order and the user would know not to expect it. The final entries in the SLIC index would therefore be [6]:

Table 2.72 SLIC Indexing

SLIC A-Z index
Aluminium : cans : welding
Aluminium : welding
Cans : welding
Welding

producing a much more economical index and supporting the classification on the shelves, by bringing together aspects of aluminium [6].

i) Precis And Compass

Another system, Precis (the Preserved Context Indexing System), can also be automatically generated and again is a system designed to delimit the number of entries necessary and to cater for the preferred approach of the user. Precis was designed by Derek Austin and was used for some years to generate the subject headings which appeared in BNB. The idea of Precis is what whichever term a user employs to approach his or her subject, when the index is consulted he or she will find that term accompanied by a kind of precis or summary of the

context in which the term has been dealt with by the author of the document located. The layout of the heading indicates the relationship of the terms used [6]:

Table 2.8 Precis and Compass Indexing

LEAD (sought term)	Qualifier (the wider context)
Display (narrower context)	
Acupuncture	Holistic medicine
Pain relief	

Classificatory principles are very much in evidence here, in that the specific entry is being shown in its hierarchical relation to the other elements in the subject of the documents. Precis also necessitates the concept analysis of documents in a manner very familiar to the classifier. It is not, however, linked to any single classification as chain indexing is in practice. Role operators are used to indicate meaning by the interpolation of semantic links such as 'of into strings which would otherwise be capable of misinterpretation. Precis replaced the chain index which had been in use for BNB : Precis, itself, was then to be usurped in 1990. The latest system in use by the British Library is Compass (the Computer Aided Subject System), which is basically a simpler and less labour-intensive method of creating an index. The resultant entries produce a simplified subject description, which was all that was felt necessary for subject searching. Compass retains some of Precis' special features, such as role operators, and allows for the meaningful access to the records available in BNB [6].

2.6 Search Strategy Construction

a) Boolean Logic

The relationship AND and OR are logical connectors from a system known as Boolean logic. The system is named after George Boole, the mathematician who invented it. Boolean logic is a combination system that represents symbolically the relationships between sets or concepts. In the above examples, the relationship between concepts was started in narrative form (e.g., vitamin C AND the common cold); it is also useful to examine the relationships in pictorial form [3].

b) Subject Searching

In discussing subject searching, it is necessary to distinguish between free-text and controlled vocabulary searching. Free-text searching utilizes every significant word in the title, the abstract, and other designated searchable fields. Controlled vocabulary searching limits the retrieval to index terms (or descriptors) which have been assigned to the record [3].

c) Adjacency Searching

The concept of adjacency is important when searching in a free-text mode. Adjacency refers to the ability to specify that two or more words appear in a particular relationship, such as next to each other in a specified order or with some maximum number of intervening words. Its use reduces the problem of "false drops" (irrelevant retrieval) [3].

This search was performed on the ERIC (Educational Resources Information Center) database using the BRS (Bibliographic Retrieval Services) system. The BRS adjacency operator, "ADJ", demonstrates the different number of records retrieved with "higher ADJ education" as compared to "higher AND education". In some systems it is possible to specify that the terms be within a certain distance, in DIALOG, adjacency is represented by "(W)". If one wishes the word "future" to fall within three words of "planning", the phase would be input as "future(3W)planning" [3].

d) Author Searching

Author Name Format

Nearly all bibliographic databases allow the searcher to retrieve items by author. Before attempting to do so, the appropriate database manual should be consulted to determine the rules governing the input of authors' names. For example, is access provided to all authors of a document, only the first three authors, or only to the first author listed ? Thus, if a database provides access only to the first author, it will not be possible to identify works by an individual when that person was a co-author [3].

The searcher must also determine the exact format that was used to enter the authors' names into the database. For instance, some databases input all authors as last name first, followed by initials (e.g., Smith JP). Other databases may use the full first name of the author (e.g., Smith Jane P). Variations exist in the form of punctuation, such as whether to put a comma after the surname. Because the computer matches on a character-by-character basis, the format of the search

term must be precisely the same as the format in the database in order for a match to occur [3].

In some databases the author name format will be not standardized; the name will be entered exactly as it appears in the document. If not standardized, it is not unusual for an author's name to appear in multiple forms within the same database. For example, Jane Smith may appear in one database in all of these forms [3] :

- Smith J
- Smith, J. P.
- Smith Jane P
- Smith Jane Paula

Ignoring the rules of input can drastically affect one's retrieval when performing an author search. These types of differences are the result of the methods used to create the database by the producers, not the way in which it is processed by the search system vendors [3].

e) Citation Searching

Two databases, Science Citation Index and Social Science Citation Index, allow the searcher to retrieve documents which cite a particular work authored by a given individual. For example, if J. P. Guilford published an article in 1962, it would be possible to determine how many times (and by whom) it has been referenced in recent years. Citation searching is useful for identifying works in a limited subject area, based on the assumption that authors working in the area will cite a classic earlier work. It is also useful in searching topics that cross

several subject areas in which different vocabulary terms apply. One can identify records based on known authors working in the field rather than using subject terms that may be imprecise in describing the topic [3].

When performing citation searching, it is helpful to have a complete reference to the cited article. Expanding on the author name is one way to determine the form of the citation in the database. Notice that the citations are entered as they are found and that variant forms may be stored in the database [3].

2.7 Summary

In this chapter, the online information system is reviewed and information systems can be divided into different types such as management information system (MIS), database management system (DBMS), decision support system (DSS), question-answering system (QA) and information retrieval system (IR).

The purpose of classification is to decide where to put a given document or object. The five major general classification schemes are Dewey Decimal Classification (DC), Library of Congress Classification (LC), Universal Decimal Classification (UDC), Colon Classification (CC) and Bibliographic Classification. The purpose of indexing is to facilitate the finding of information. Some indexing methods are subject indexes, title indexing, keyword-from-title-indexes, derivative and assignment indexes, author indexes, citation indexing, chain indexing, selective listing in combination indexing and Precis and Compass indexing.

Boolean logic is reviewed for the search strategy construction. In addition, subject searching, adjacency searching, author searching and citation searching are also included in the review.

[1] *Collins English Dictionary, Millennium Edition.* HarperCollins Publishers, 1999.

[2] Ralston, Anthony and Reilly, Edwin D., *Encyclopedia of Computer Science.* New York, International Thomson Computer Press, 1995.

[3] Borgman, Christine L., Moghdam, Dineh and Corbett, Patti K., *Effective Online Searching.* New York, Marcel Dekker, Inc., 1984.

[4] Salton, Gerard and McGill, Michael J., *Introduction to Modern Information Retrieval.* New York, McGraw-Hill Book Company, 1983.

[5] Paice, C.D., *Information Retrieval and the Computer.* London, Macdonald and Jane's Publishers Ltd., 1977.

[6] Marcella, Rita and Newton, Robert, *A New Manual of Classification.* London, Gower Publishing limited, 1994.

CHAPTER III

SYSTEM ANALYSIS AND DESIGN

3.1 Project Development Strategy

The project development strategy is a description of the way which this project is done in actuality. The development strategy for this project is based on the software prototyping model. Prototyping development is an idea of developing an initial implementation, expose it to the user for comment and refining it through many versions until an adequate system has been developed. Rather than having separate specifications, development and validation activities, these are carried out concurrently with rapid feedback across these activities [1]. This is based on the six steps which show below [2] :

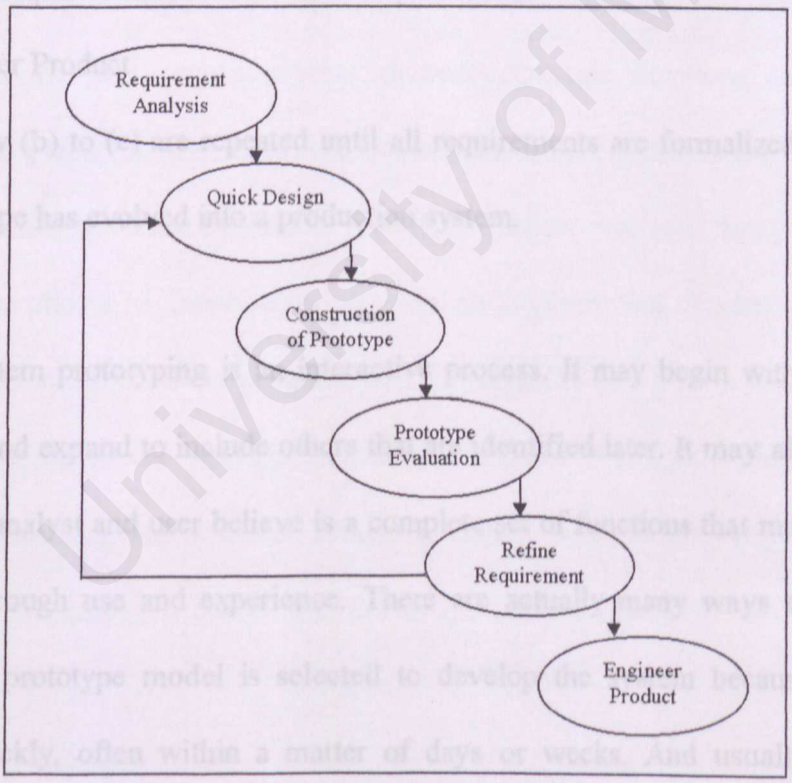


Figure 3.1 Software Prototyping Model

a) Requirement Analysis

To carry out research and analysis, and to develop an abbreviated representation of the requirements.

b) Quick Design

Quick design on software system functions which may be enhanced in later phase.

c) Construction of Prototype

Prototype software is created, tested and redefined.

d) Prototype Evaluation

The tested version of the prototype is presented to the user to test and suggest modifications.

e) Refine Requirement

Justify requirements or add in new requirements.

f) Engineer Product

Activity (b) to (e) are repeated until all requirements are formalized or until the prototype has evolved into a production system.

System prototyping is an interactive process. It may begin with only a few functions and expand to include others that are identified later. It may also start with what both analyst and user believe is a complete set of functions that may expand or contract through use and experience. There are actually many ways to develop a system. A prototype model is selected to develop the system because it can be created quickly, often within a matter of days or weeks. And usually, it is also relatively inexpensive to build, compared with the cost of developing a conventional system. The emphasis is on trying out ideas and providing assumptions about requirements, not on system efficiency or completeness.

3.2 Authoring Tools

a) Microsoft Visual Basic 6.0

Visual Basic is used to develop this system because it provides a set of tools that makes it easy to develop powerful Windows applications [4]. The "Visual" part refers to the method used to create the graphical user interface (GUI). Rather than writing numerous lines of code to describe the appearance and location of interface elements, just simply add prebuilt objects into place on screen. The "Basic" part refers to the BASIC (Beginners All-Purpose Symbolic Instruction Code) language, a language used by more programmers than any other language in the history of computing. Visual Basic has evolved from the original BASIC language and now contains several hundred statements, functions, and keywords, many of which relate directly to the Windows GUI. Beginners can create useful applications by learning just a few of the keywords, yet the power of the language allows professionals to accomplish anything that can be accomplished using any other Windows programming language [5].

Visual Basic also provides data access features is to create databases, front-end applications, and scalable server-side components for most popular database formats, including Microsoft SQL Server and other enterprise-level databases [5].

b) Microsoft Access 97

Microsoft Access is a stand-alone relational database product. Access includes two features that can be used by Visual Basic programmers – Data Access Objects (DAO) and Microsoft Jet. The Jet database engine is the data manager on

which Microsoft Access is built. Jet can be manipulated by DAO using VB code or with the intrinsic data control using no code [6].

The Visual Basic 6.0 intrinsic data control takes advantage of DAO to provide even simpler data access using bound controls. The DBList, DBGrid and DBCombo controls, when bound to an intrinsic data control, can provide nearly all of the DAO functionality without even having to write any code [6].

VisData (which happens to be written in Visual Basic) is a program that provides a graphical front end to create and manipulate Access databases. So VisData is a limited front-end to Access tables. VisData communicates with the database by using DAO and Jet [6].

3.3 System Analysis

The analysis phase of this system involves eliciting user requirements. A requirement is a feature of the system or a description of something the system is able to do in order to fulfil the system objectives. The requirements identify what of the system and the design identifies how of the system [3]. There are many ways to obtain the user requirements, some examples are survey, interview, observation, simulation and studying the existing systems.

For this project, the methods which are used to obtain the user requirements are interview, observation and studying the existing systems. The interview and observation is done on different levels and ages of people like students, lecturers, librarians, friends and parents. The purpose of analysis is to know how the users keep, place and manage their own reading materials. The existing system like the OPAC in the library of Malaya University is also studied to know how a big system

works. In addition, the history of classification and indexing methods of some libraries all around the world are obtained from books.

3.31 System Requirements

Requirements can be described as the system behavior and divided into two parts, one is functional requirement and the other one is non-functional requirement.

a) Functional Requirements

A functional requirement describes an interaction between the system and its environment [3]. The functional requirements of this system are :

i) Data Entry Module

This module enables the administrator to add, modify or delete the records which are stored in the database.

ii) Searching and Retrieving Module

This module enables the users to search all the records base on the author's name, book title, subject or keyword and list out all the related reading materials in a sorted form.

iii) Help Module

This module provides some help and usage information about the system to the user.

b) Non-functional Requirements

A non-functional requirement or constraint describes a restriction on the system that limits the choices for constructing a solution to the problem [3]. The non-functional requirements of this system are :

i) Security

Before accessing the system, the users are required to login their user ID and password. Only authorized user with successful login can use the system.

ii) User Friendly Interfaces

The interfaces of this system are simple and easy to understand, therefore the users will be able to use it within a short period.

iii) Response time

As the system provides searching and retrieving function, a reasonable response time is needed.

3.32 Reading Materials Classification and Indexing

The reading materials can be divided into 2 main categories, they are hardcopy and softcopy.

a) Hardcopy

Hardcopy can be described as information that is printed on paper such as books, journals, magazines, newspaper cutting and etc.

b) Softcopy

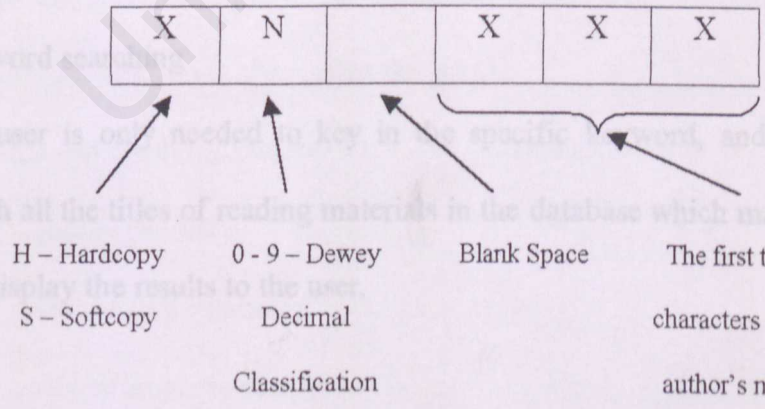
Softcopy can be described as information that is stored inside electronic storage devices like diskette, CD-ROMs and Internet locations.

The reading materials are then divided into smaller classes. This division is based on the Dewey Decimal Classification (DC). The DC classification divides all the reading materials into ten large classes, they are :

Table 3.1 Dewey Decimal Classification

0	General works
1	Philosophy and psychology
2	Religion
3	Social sciences
4	Philology
5	Natural sciences and mathematics
6	Technology
7	The Arts
8	Literature and rhetoric
9	Geography and History

The reading materials which are from the same class will be grouped and placed together on the bookshelves. As there are many hardcopy reading materials, an easy method of finding books on the bookshelves is needed. Therefore the author's name is also used for systematic arrangement of books. The format of the call number which can be found on the books are shown below :



The indexing method which is used in the system is title indexing. All the information of reading materials will be stored inside the database and can be

retrieved by the users. The searching and retrieving can be done based on the reading material title, subject, author or keyword. All the information of related reading materials will be displayed in a sorted form.

3.33 Searching Methods

One of the main features in this system is the ability for the users to search the needed reading materials. The searching methods which can be used are :

a) Title Searching

The user can key in the title of the book and all the matched titles will be displayed with its information for the user.

b) Subject searching

The subject of the needed book can be keyed in and all the related books information will be displayed for the user.

c) Author searching

All the books information with the same author will be retrieved if the user key in the author's name in the correct format.

d) Keyword searching

The user is only needed to key in the specific keyword, and the system will search all the titles of reading materials in the database which match the keyword and display the results to the user.

3.34 Reading Materials Types

Different reading materials have different attributes, therefore the properties of books, journals and magazines are also different. The properties of all the reading material types which are in this system are listed below :

a) Book - author, book title, place of publishing, publisher and year of publishing

b) Journal - editor, article title, journal title, volume, year of publishing and relevant pages

c) Magazine - magazine title, volume and date of publishing

d) Dictionary - title, publisher and year of publishing

e) Other article - author, article title, source and date

f) Diskette and CD-ROM - author, title, publisher and year of publishing

g) Internet location - author, title, URL location and last update date

3.4 System Design

Design is the creative process of transforming the problem into a solution; the description of a solution is also called design [3].

High quality design should have characteristics that lead to [3] :

- quality products
- ease of understanding
- ease of implementation
- ease of testing
- ease of modification

- correct translation from the requirements specifications.

There are 3 kinds of designs in this chapter, which are database design, program design and user interface design.

3.41 Database Design

This system will utilize Microsoft Access 97 as its database. The general objectives in the design of data storage are [7] :

- data availability
- data integrity
- efficient updating and retrieval
- efficient data storage
- purposeful information retrieval.

The data must be available when the user requests for it and also consistent and accurate. The database design has to facilitate efficient data storage and efficient updating and retrieval. In addition, the data stored must be in a useful form for planning or decision making.

3.42 Data Dictionary

The database will contain five tables, there are tbl_User, tbl_AuditTrail, tbl_Hardcopy, tbl_Softcopy and tbl_Temp. The user table will contain all the information of users like names, IDs and passwords. The audit trail table will record the user's name, login and logout date and time. The hardcopy and softcopy tables

will keep all the information of reading materials. The temporary table is for searching and retrieval.

Table 3.2 Table tbl_User

Key	Field Name	Data Type	Size	Required	Description
	UserName	Text	30	✓	User name
✓	UserID	Text	10	✓	User ID
	UserPassword	Text	10	✓	User password
	Active	Text	1	✓	Y or N

Table 3.3 Table tbl_AuditTrail

Key	Field Name	Data Type	Size	Required	Description
✓	UserID	Text	10	✓	User ID
	UserName	Text	50	✓	User Name
	LoginDT	Date/Time		✓	Login date and time
	LogoutDT	Date/Time		✓	Logout date and time
	FormName	Text	50	✓	Form Name

Table 3.4 Table tbl_ReadingM

Key	Field Name	Data Type	Size	Required	Description
	ReferenceNo	AutoNum		✓	Reference Number
✓	Title	Text	30	✓	Title
	ArticleTitle	Text	30		Article title
	Subject1	Text	30	✓	Subject 1
	Subject2	Text	30		Subject 2
	Author	Text	30		Author
	Publisher	Text	30		Publisher
	PlaceP	Text	20		Printing place
	YearP	Number			Publishing year
	Volume	Number			Volume
	DateP	Text	20		Publishing Date
	Page	Text	20		Page
	URL	Text	50		URL location
	Source	Text	20		Source
	CallNumber	Text	20		Call number
	MLA1	Text	200	✓	Record format 1
	MLA2	Text	200	✓	Record format 2
	Type	Text	50	✓	Type

Table 3.6 Table tbl_TempSearch

Key	Field Name	Data Type	Size	Required	Description
	MLA1	Text	200	✓	Record format 1
	MLA2	Text	200	✓	Record format 2
	CallNumber	Text	20		Call number
	Type	Text	50	✓	Type

3.43 Data Flow

The administrator can add, modify or delete data in the database. Users can be added or deleted and the audit trail log is also can be viewed by the administrator. The users need to login and then can search and retrieve records from the database. In addition, the users also can change their password.

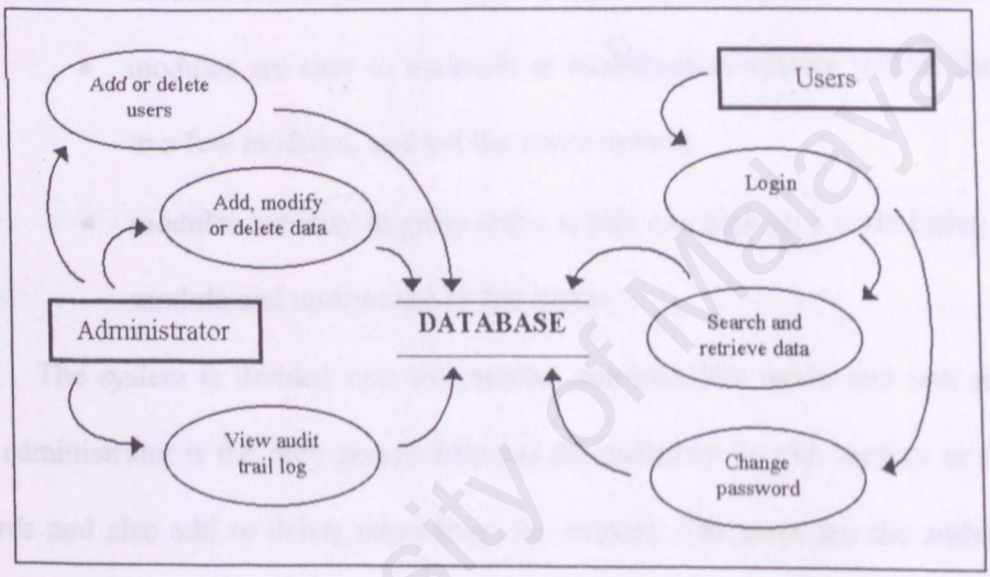


Figure 3.2 PLIMIS Data Flow Diagram

3.44 Program Design

The top-down design is used in this system. A top-down design looks at the large picture of the system and then breaks it into smaller parts. This approach allows the developer to ascertain the overall objectives of the system first, then the system is divided into smaller parts.

The advantages of the top-down design are [7] :

- avoiding the chaos of attempting to design a system all at once

- prevents developer from getting mired in detail that they lose sight of what the system is supposed to do.

The modular approach is useful in programming when the top-down approach is adopted. In addition, it involves breaking programming into logical and manageable modules. The benefits of modular program design are [7] :

- modules are easy to write and debug because they are self-contained
- modules are easy to maintain as modification usually will be limited to a few modules, and not the entire system
- modules are easy to grasp and a reader can pick up a code listing of a module and understand its functions.

The system is divided into two modes, administrator mode and user mode. The administrator is the only person who has the authority to add, modify or delete records and also add or delete users from the system. The users are the authorized people who can use the system after a successful login. The users can search and retrieve records from the database and also change their passwords.

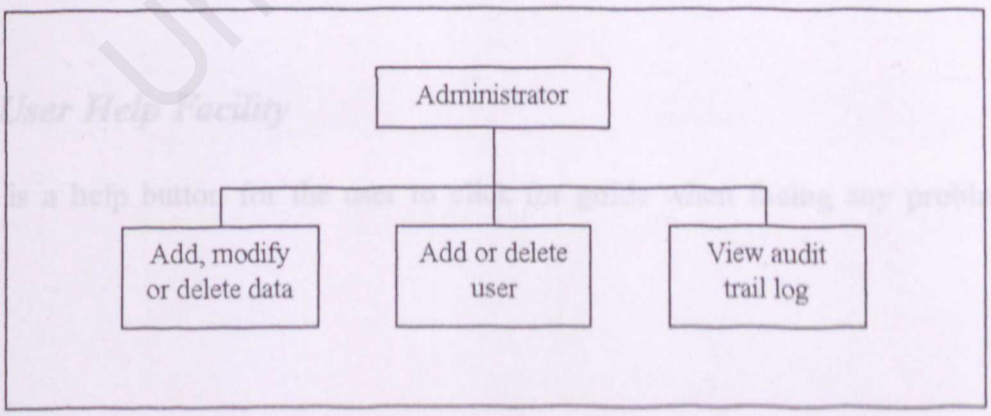


Figure 3.31 Administrator Structure Chart

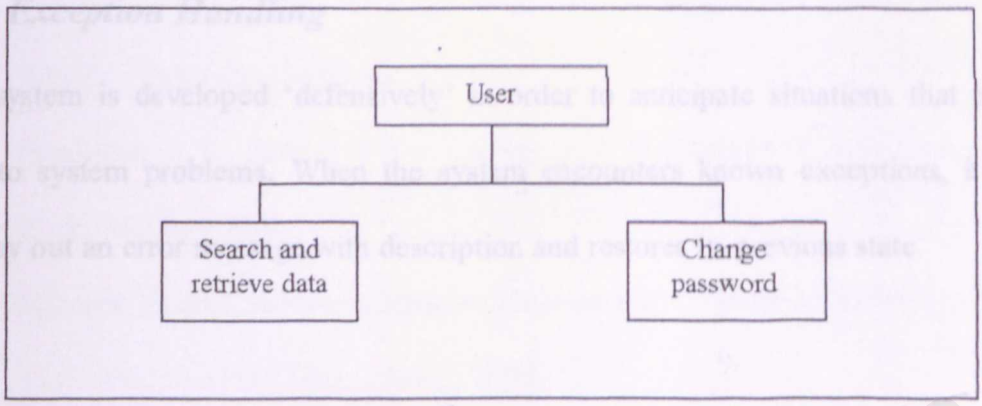


Figure 3.32 User Structure Chart

3.45 User Interface Design

PLIMIS has simple user interfaces for ease of use and understanding. The prototype of interfaces are showed in the Appendix.

3.5 System Response Time

With the searching and retrieving function, the system will not hold for a long time. It with give results to the user within 10 seconds.

3.6 User Help Facility

There is a help button for the user to click for guide when facing any problem or doubt.

3.7 Exception Handling

The system is developed 'defensively' in order to anticipate situations that might lead to system problems. When the system encounters known exceptions, it will display out an error message with description and restores its previous state.

[1] Sommerville, I., *Software Engineering, 5th Edition.* New York, Addison-Wesley Publishing Company, 1995.

[2] Pressman, R.S., *Software Engineering : A Practitioner's Approach.* New York, McGraw Hill, 1992.

[3] Pfleeger, Shari Lawrence, *Software Engineering – Theory and Practice.* New York, Prentice-Hall International, 1998.

[4] Warner, Scott, *Teach Yourself Visual Basic 6.* New York, Osborne / McGraw-Hill, 1998.

[5] MSDN Library Visual Studio 6.0a

[6] Connell, John, *Beginning Visual Basic 6 Database Programming.* Canada, Wrox Press Ltd., 1998.

[7] Kendall, Kenneth E. and Kendall, Julie E., *Systems Analysis and Design, 3rd Edition.* New York, Prentice Hall, 1995.

CHAPTER IV

CODING

4.1 Coding Approach

Coding is an iterative process whereby it is done until the programmer obtains the desired results. There are two types of coding approach, one is top-down and the other one is bottom-up. The bottom-up coding is based on coding some complete lower level modules and leaving the high level modules merely as skeletons that are used to call the lower modules, whereas the top-down approach is the reverse.

For this system, coding is done with the bottom-up approach. The advantages of this approach are : testing can be carried out on some of the functions as soon as it is completed, and critical functions can be coded first to test their efficiency.

4.2 Coding Tools

This system is developed using Microsoft Visual Basic 6.0, Microsoft Access 97 and Seagate Crystal Reports 7.

4.21 Microsoft Visual Basic 6.0

Visual Basic is used to develop this system because it provides a set of tools that make it easy to develop powerful Windows applications [4]. The "Visual" part refers to the method used to create the graphical user interface (GUI). Rather than writing numerous lines of code to describe the appearance and location of interface elements, just simply add prebuilt objects into place on the screen. The "Basic" part refers to the BASIC (Beginners All-Purpose Symbolic Instruction Code) language, a language used by more programmers than any other languages in the history of computing. Visual Basic has evolved from the original BASIC language and now contains several hundred statements, functions, and keywords, many of which relate directly to the Windows GUI. Beginners can create useful applications by learning just a few of the keywords, yet the power of the language allows professionals to accomplish anything that can be accomplished using any other Windows programming language [1].

Visual Basic also provides data access features to create databases, front-end applications, and scalable server-side components for most popular database formats, including Microsoft SQL Server and other enterprise-level databases [1].

4.22 *Microsoft Access 97*

Microsoft Access is a stand-alone relational database product. Access includes two features that can be used by Visual Basic programmers – Data Access Objects (DAO) and Microsoft Jet. The Jet database engine is the data manager on which Microsoft Access is built. Jet can be manipulated by DAO using VB code or with the intrinsic data control using no code [2].

The Visual Basic 6.0 intrinsic data control takes advantage of DAO to provide even simpler data access using bound controls. The DBList, DBGrid and DBCombo controls, when bound to an intrinsic data control, can provide nearly all of the DAO functionality without even having to write any code [2].

VisData (which happens to be written in Visual Basic) is a program that provides a graphical front end to create and manipulate Access databases. So VisData is a limited front-end to Access tables. VisData communicates with the database by using DAO and Jet [2].

4.23 *Seagate Crystal Reports 7*

Seagate Crystal Reports is a powerful stand-alone report creation application. It provides a report writing module that you can add to your own applications. As a developer using C, C++, Visual Basic, ObjectVision, Turbo Pascal, Visual dBASE, Delphi, or any programming language that can access a DLL, you can add sophisticated report generating and printing capabilities to your applications without the time-consuming task of writing your own code.

The Crystal Report Engine (CRE) is a Dynamic Link Library (DLL) that allows your applications to access the same powerful report printing features that are available in Seagate Crystal Reports. As a licensed user of Seagate Crystal Reports, you receive royalty-free rights to ship the CRE DLL (CRPE.DLL or CRPE32.DLL) and all of its support files with any application you create.

4.3 Program Documentation

Program documentation is a set of written descriptions that explain to a reader what the programs do and how they do it [3].

4.31 Naming Convention

Naming convention is an abbreviation of the control name or the object name. This system uses a naming convention to ensure uniformity of the control and object names. The purpose of this naming convention is to increase the readability of the codes. For example :

Table 4.1 Naming Convention

Control	Control Name	Example
Form	frm_	frm_UserSetup
Command Button	cmd_	cmd_Close
Text Box	txt_	txt_UserName

4.32 Internal Documentation

Internal documentation is a description material written directly within the code [3]. It means that internal documentation refers to comments within the codes. This is needed to enhance readability of the code by someone other than the programmer. It will also help the programmer to recall the function or meaning of certain codes.

For Visual Basic, the comment tag is illustrated below :

```
' This is a comment
```

Any text after this symbol ' will be ignored during execution time. All the comments are in green color.

Codes are also formatted to enhance understanding. Spacing or line brake in between different section of the codes will enhance readability too.

4.4 Coding Specification

There are three main modules in this system, Administrator Module, User Module and Help Module. The Administrator Module is divided into four sub-modules and the User Module is divided into two sub-modules.

The sub-modules of the Administrator Module are Add Record, Delete Record, User Setup and User Audit Trail. The Add Record sub-module is for the administrator to insert reading material details into the database and the Delete Record sub-module is to delete specific record from the database after searching the reference number. The User Setup sub-module is to add, update or delete user from the database. The User Audit Trail sub-module is to trace user audit trail based on user id or login date.

The sub-modules of the User Module are Search Record and User Setup. The Search Record sub-module is to search certain reading material record based on title, subject or author's name searching. The User Setup sub-module is to change user password.

The Help Module provides useful information to administrator and user, such as brief explanation about the function of sub-modules and examples.

4.5 Data Validation

Data validation is performed before record is inserted into the database. The purpose of this feature is to make sure invalid data will not inserted into the database and cause error.

4.6 User Interface

This system is user friendly with its simple forms and uniformity to enhance readability and ease of use.

[1] MSDN Library Visual Studio 6.0a

[2] Connell, John, *Beginning Visual Basic 6 Database Programming*. Canada, Wrox Press Ltd., 1998.

[3] Pfleeger, Shari Lawrence, *Software Engineering – Theory and Practice*. New York, Prentice-Hall International, 1998.

CHAPTER V

TESTING

5.1 Testing Strategy

There are three types of testing, namely, unit testing, module testing and integration testing. After a program is completely coded, it will be tested under unit testing. Module testing will start when all the programs under a particular module have been completely coded and tested under unit testing. The integration testing is to recover errors associated with interfacing when integrating all the modules.

The objective of testing is to find error and fault. Fault identification is the process of determining what fault or faults caused the failure, and fault correction or removal is the process of making changes to the system so that the faults are removed [1].

5.2 Type of Faults

Faults can be categorized as algorithmic faults, syntax faults and documentation faults [1]. Algorithmic fault occurs when a program algorithm or logic does not produce the proper output for a given input because something is wrong with the processing steps. Syntax fault can be checked while parsing for algorithmic faults. This will ensure that the construct of programming language is used properly. Documentation fault occurs if the documentation does not match what the application does, and such faults can lead to other faults later because of the wrong implementation.

5.3 Unit Testing

Unit testing tries to look for all the possible errors that will occur in a program. A complete test process should test all of the following categories of test data :

a) Normal data – to test a given correct data will produce the expected results

b) Erroneous data – for a given erroneous data, like invalid date format, does the system detect it or not ?

c) Boundaries value analysis – data that are out of the range specified will be used to test the system because errors may occur at the extreme point

d) Condition testing data – some functions may be active under certain condition, therefore a set of data are tested on all possible conditions

Unit testing involves testing each program on its own, isolated from the other programs in the system. The following steps specify how unit testing is carried out for this system :

a) The code of the program is examined by reading through it to spot for algorithmic faults and syntax faults.

b) All command buttons, text boxes and other control objects are tested to check its functionality.

c) Different types of test data are used like number, character, date and etc. to test all the control objects.

d) Test cases are developed to ensure that the input is properly converted to the desired output.

5.31 Examining the Code

The codes of the program are read and walked through with documentation to identify faults. This method is useful to identify faults that have been left out by the programmer.

5.32 Control Objects Testing

Command buttons are clicked to test their functionality and text boxes are tested with different data types and also null value to make sure invalid data will not cause any fault.

5.33 Different Data Type Testing

Different data types like numbers, characters or date is used to test certain function because some control objects will only accept certain data type, invalid data type can be traced by the system without causing any error.

5.34 Choosing Test Cases

Input data and condition are chosen to test a program, then the program is allowed to manipulate the data and output is observed. Test cases are shown in Appendix .

5.4 Module Testing

Module testing is to test the MDI form of the system. All the programs under a sub-module are grouped into one form and all the related forms are grouped into a module. This testing will make sure menu bar choices will make the correct form

active and the control will pass back to the specific form when the current form is closed.

5.5 Integration Testing

When the individual programs work properly, integration testing is started. If there is a fault during the testing, the fault does not lie within the unit of the system. Sandwich integration testing approach is used for the system. This approach combines top-down strategy with bottom-up strategy. The testing starts from the login screen of the system and down to the lowest level of the form functions and from the form function back to the MDI from. This testing is repeated several times to make sure that all the control objects work properly.

5.6 Test Planning

Test planning helps in designing and organizing tests, so that testing is carried out appropriately and thoroughly. The steps for the test planning are :

a) Establishing test objective

b) Designing test case

c) Writing test case

d) Testing test case

e) Executing test

f) Evaluating test results

5.7 System Testing

System testing is to ensure that the system fulfills user requirements. The system testing involves function testing and performance testing.

5.71 Function Testing

Function testing is based on the system functional requirements. The testing is carried out for three main modules and six sub-modules. The three modules are Administrator Module, User Module and Help module. In the Administrator Module, Add Record, Delete Record, User Setup and User Audit Trail are the four sub-modules. For the User Module, Search Record and User Setup are two sub-modules. Each module is tested individually to determine whether the system performs as required.

5.72 Performance Testing

Performance testing addresses the non-functional requirements of the system. The type of performance tests are :

a) Security test – to ensure the system fulfills the security requirement

b) Timing test – to ensure the response time of the system is acceptable

c) Human factor test – simple forms and displays related message to determine user friendliness

d) Volume test – to ensure all the fields can accommodate the expected data

[1] Pfleeger, Shari Lawrence, *Software Engineering – Theory and Practice*. New York, Prentice-Hall International, 1998.

CHAPTER VI

SYSTEM EVALUATION

6.1 System Strengths

This system is evaluated systematically as follow :

a) Security

This system is implemented with security login. For both administrator and user, login is required before using the system. The login screen requires user id and password only. If the user enters the wrong password for three times, this system will not allow the user to access the system even though the correct password is entered the fourth time. The administrator needs to set the user back to active user before the user can login again with the correct password.

For security purpose, only administrator login has the full access rights to the system and can make changes to the records in the database. There will be limited access rights for other user login.

b) Simple and user-friendly interface

PLIMIS is developed by using Graphical User Interface (GUI) based development tools, therefore, all forms are kept simple. This is to provide a user-friendly system to the user for fast learning and ease of use. Command button, text box and other control objects are used to allow the user to execute command with ease. An action is just a click away and the user just needs minimal knowledge of mouse and keyboard to use this system.

c) Searching capability

A good information retrieval system is designed such that it is easy to use even for a novice user. This system allows searches by using title, subject or author's name, to retrieve record from the database.

d) Display process message

There are a lot of processes between the system and its database, therefore, it is important to inform the user what the system has done when clicking on any command button. Messages like 'Record Is Saved Successfully' or 'No Such User ID' will be displayed to inform the user. Without these messages, user might think that the system is faulty if no results are returned when a command is executed. In addition, user also knows that record is inserted into the database successfully.

e) Incorporates data validation

Data validation is done prior to insert record into the database. All the fields in the form will be checked for null value or invalid data type. With this feature, error when inserting record into the database will not occur. Error message will also be prompted to the user if important field is not filled.

f) Fast response to information retrieval

This system provides fast response to record searching and display in a report for the user.

g) Implements error handling

To avoid run time error, this system is developed with error handling. Error message will be displayed when the system encounters exceptions and it will not terminate suddenly.

h) Encryption of password

All the passwords in the system are encrypted and stored in the database. The user will not figure out the password if the database is opened by the user.

i) Help for administrator and user

Help will be provided to administrator and user in the menu bar. There are some explanations and examples for every form in the system.

6.2 System Constraints

Due to time and knowledge limitation, there are a few system constraints, all of them are discussed below :

a) Database backup

If this system is corrupted, there is no backup for the database and the user needs to reinstall the whole system. Therefore, all the reading material records will be lost and need to be entered again into the database.

b) Slow response time

If there is a lot of records in the database, the searching process will take more time because the system will search the database and then generate the search results in a report for the user.

6.3 Problems and Solutions

During the development of this system, a number of problems delay the progress of this system. All the problems and solutions are explained below :

a) Weakness of Microsoft Access 97 database

When the database is opened by the system, another component or function is not allowed to access any record in the database. Due to a component, named MSHFlexGrid, and if another function needs to access the database at the same

time, an error will occur, and this will make the system faulty because it only allows one of them to access the database.

Solution : A dummy database is created for the MSHFlexGrid to be assigned to, when another function wants to access the system database.

b) Date format

The date format of system developed is DD/MM/YYYY, but retrieving record from the database with this date format will give wrong results although the record of date in the database is also in the same format.

Solution : The format of date in Access database follows US standard using MM/DD/YYYY. Although record is inserted using DD/MM/YYYY format, retrieving record will give wrong results if the format is DD/MM/YYYY. Therefore, date format should be MM/DD/YYYY to retrieve record from the database.

c) Error during packing the source code

Error message is displayed and caused the packaging process to idle without any progress when the source code is compiled and packed to become setup file.

Solution : When packaging the source code, a setup list file will be generated. In the setup list file, there is one line missing a path. Therefore, open the setup list file with Notepad and add the path to the specific line, then save the file and pack the source code again.

d) Error during setup

During installation of PLIMIS, error message will be prompted out a few times.

Solution : This is the problem of Visual Basic packaging tool. The user just needs to click ignore and continue installation. This installation error will not cause any faulty to the system.

6.4 Future Enhancements

System development is a dynamic process and changes must be expected. For this information system, there can still have some improvements. However, one can hardly create a perfect system and PLIMIS is no exception. Here are some suggestions for future enhancements :

a) Database backup

Once the system is corrupt, all the records in the database will lost and reinstall is needed to do again. This will take a lot of time to enter again all the reading material details into the database. Therefore a backup set of database is needed for restoring the old records.

b) Short article storing

The system allows the administrator to type in short article and store in the database. This kind of article then can be search and view by the user with relevant search key.

c) Boolean searching

If the amount of reading material records are large in the database, Boolean searching method like AND and OR is also can be added to the system to enhance the searching capability.

6.5 Knowledge and Experience Gained

From the beginning of this project until the final documentation, a number of problems have occurred and experiences are learned from there. This project gives a lot of benefit and knowledge, there are :

a) The importance of all phases in SDLC

System analysis is an important phase in the system development life cycle (SDLC). This phase capture user requirements and the goal of the system. If this phase is wrong defined, it will cause faulty to the system development and later progress. With a complete and thorough system analysis, the system that is developed will fulfill all the requirements and achieve its goal.

System testing is also an important phase in SDLC. There is no application that is free of error in this world. However, with the procedures in the system testing phase, errors and faults in the system can be minimized. The functionality of each module or form can also be tested and confirmed that it meets the user requirements.

b) Development tools knowledge

This project is using Microsoft Visual Basic 6.0 (VB), Microsoft Access 97 and Seagate Crystal Report 7 as authoring tools. VB is a very powerful development tool for developing Windows environment information system. It is easy to use and provides graphical user interface. MS Access 97 is used as database for this system, it is a database program suitable for storing records which data are not very large. In addition, the weaknesses of Access database is discover and solution is also can be figure out. Seagate Crystal Report is a powerful tool for generating report. It provides component to be added in VB to call out its report.

Report is easy to design and also has the print report function, therefore no extra coding is needed to do this task.

c) Library science knowledge

After the literature review, a lot of library science knowledge is learned. A huge library information system like OPAC in University of Malaya is studied to know its functionality. International reading material classifications and indexing methods knowledge are also learned from the review.

CHAPTER VII

CONCLUSION

7.1 Conclusion

PLIMIS is a management information system to manage and organize personal collection of reading materials. This system also provides a good indexing system for placing and arranging of reading materials. The searching and retrieving of records feature allows user to search a specific record in the database. This allows user to find a specific book easily because all the reading materials are systematically arranged with a good indexing system. In addition, all the relevant records with their details will also be displayed for the user in a short period of time.

This project gives me an opportunity to build a full application from scratch. It is a great challenge to develop a system alone. From this project, I have gained invaluable knowledge and experience during the progress of it. The knowledge which I obtained from university in these three years time gives me a strong foundation to take this project as long as to complete it. In addition, useful techniques which have learned are applied to this project.

This thesis makes me realize that tertiary education provides the foundation of computer science and information technology to undergraduates. There are more things to learn and experience in this fast growing world of information age. One has to constantly update oneself to keep up with the changing technology.

All in all, this thesis has armed me with invaluable knowledge and experience. As a result, I am better prepared to face future challenges in life.

CHAPTER VIII

REFERENCES

[1] *Collins English Dictionary, Millennium Edition.* HarperCollins Publishers, 1999.

[2] Ralston, Anthony and Edwin D. Reilly, *Encyclopedia of Computer Science.* New York, International Thomson Computer Press, 1995.

[3] Borgman, Christine L., Dineh Moghdam and Patti K. Corbett, *Effective Online Searching.* New York, Marcel Dekker, Inc., 1984.

[4] Salton, Gerard and Michael J. McGill, *Introduction to Modern Information Retrieval.* New York, McGraw-Hill Book Company, 1983.

[5] Paice, C.D., *Information Retrieval and the Computer.* London, Macdonald and Jane's Publishers Ltd., 1977.

[6] Marcella, Rita and Robert Newton, *A New Manual of Classification.* London, Gower Publishing limited, 1994.

[7] Sommerville, I., *Software Engineering, 5th Edition.* New York, Addison-Wesley Publishing Company, 1995.

[8] Pressman, R.S., *Software Engineering : A Practitioner's Approach.* New York, McGraw Hill, 1992.

[9] Pfleeger, Shari Lawrence, *Software Engineering – Theory and Practice.* New York, Prentice-Hall International, 1998.

[10] Warner, Scott, *Teach Yourself Visual Basic 6.* New York, Osborne / McGraw-Hill, 1998.

[11] MSDN Library Visual Studio 6.0a

[12] Connell, John, *Beginning Visual Basic 6 Database Programming.* Canada, Wrox Press Ltd., 1998.

[13] Kendall, Kenneth E. and Julie E. Kendall, *Systems Analysis and Design, 3rd Edition*. New York, Prentice Hall, 1995.

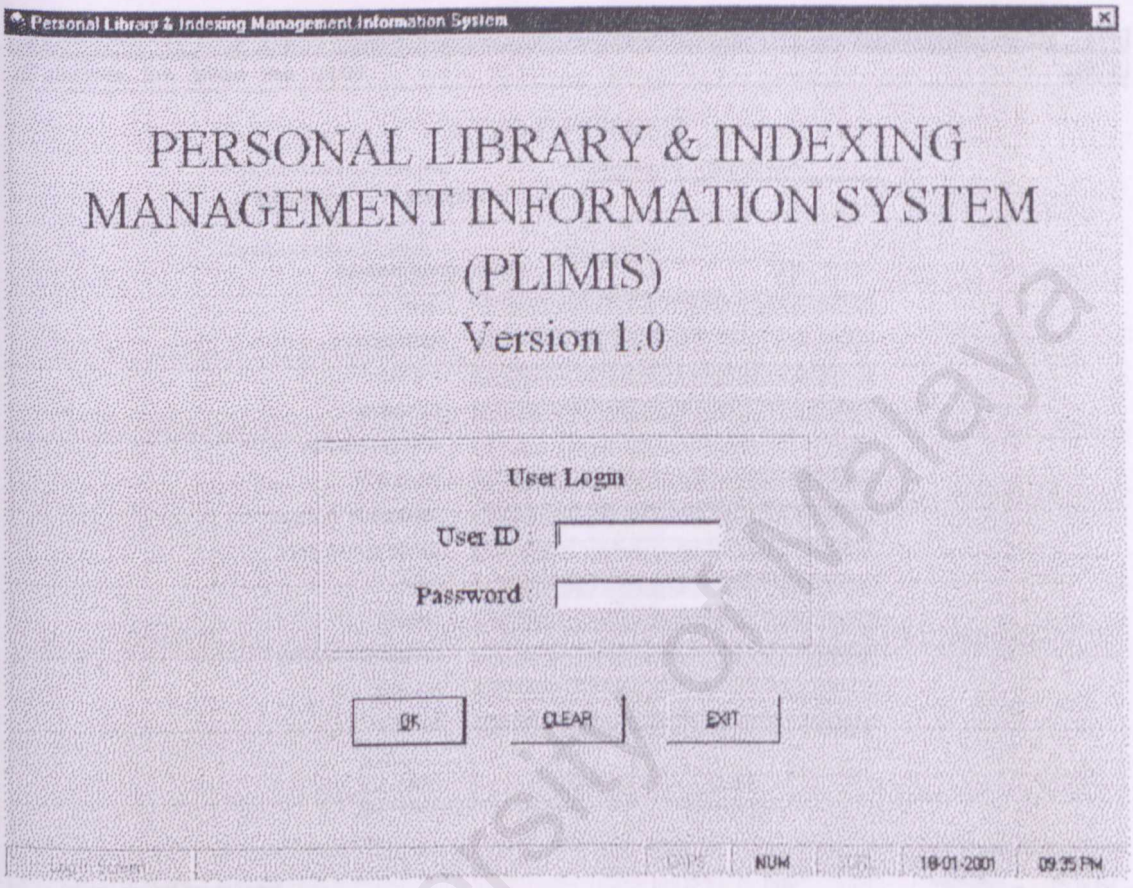
[14] *Buku Panduan Kursus Kemahiran Maklumat, Modul Sastera & Sains Social 1999*. Kuala Lumpur, Unit Kemahiran Maklumat PUM, 1999.

APPENDIX A

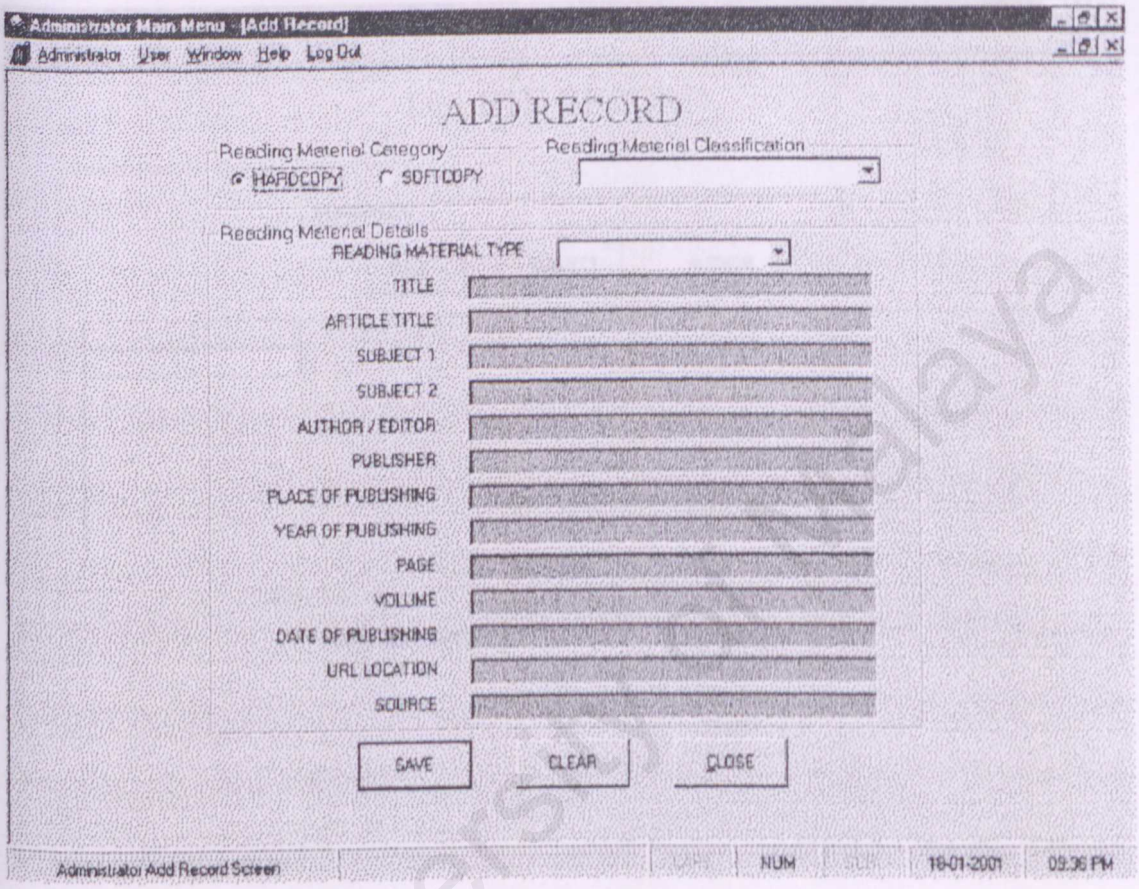
USER INTERFACE

Appendix A – User Interface

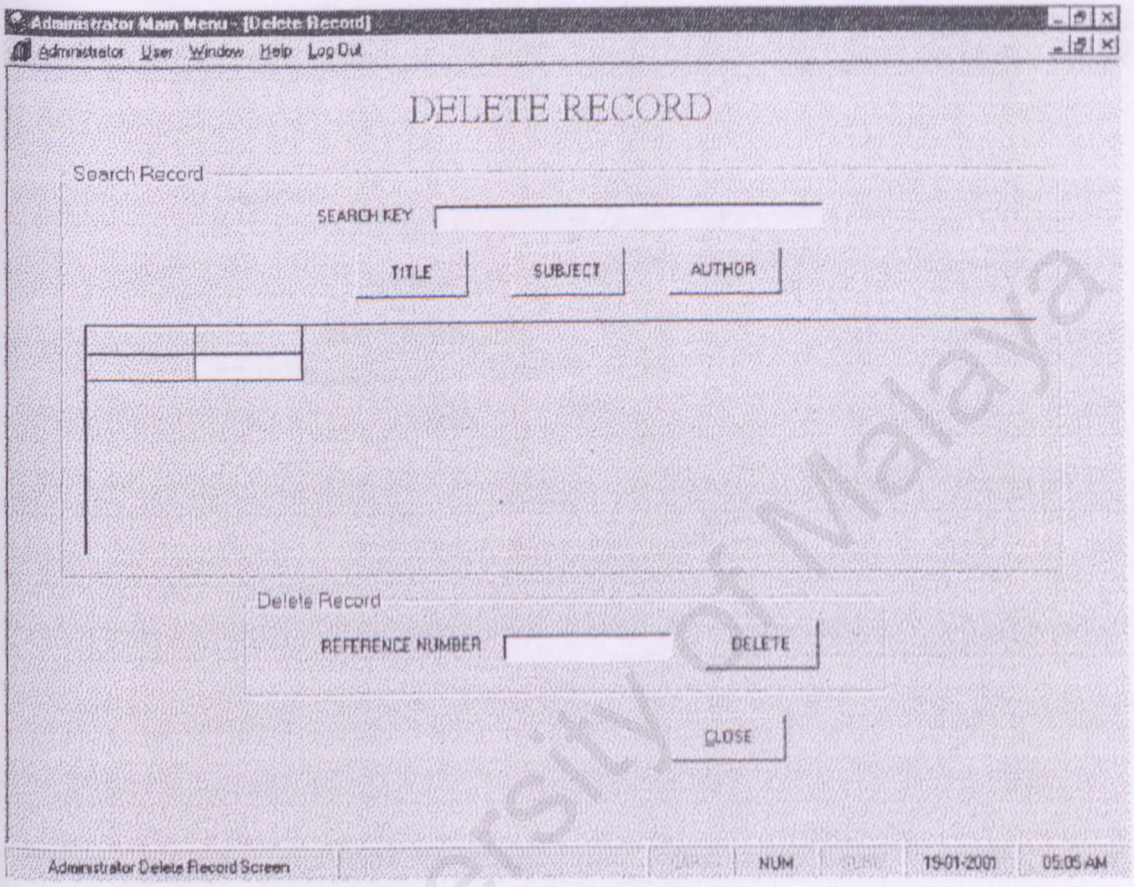
a) Log In Screen



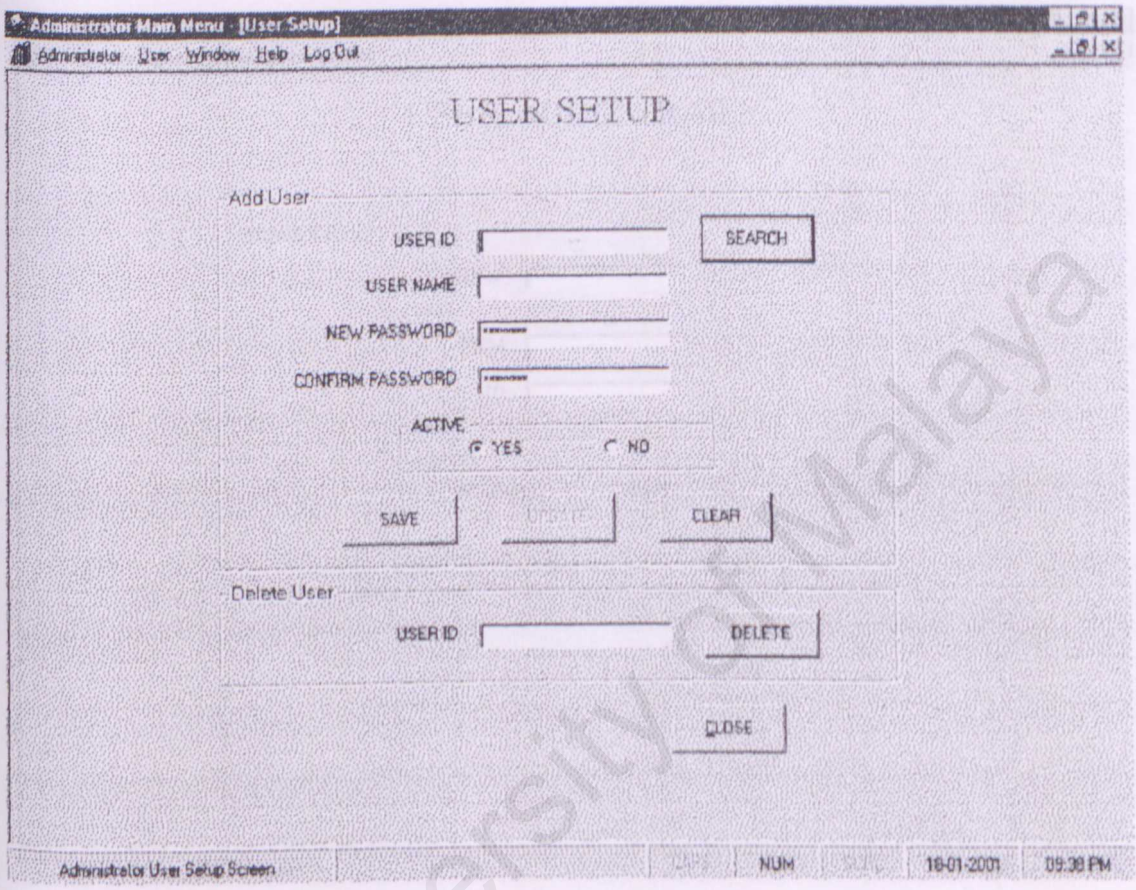
b) Administrator Add Record Screen



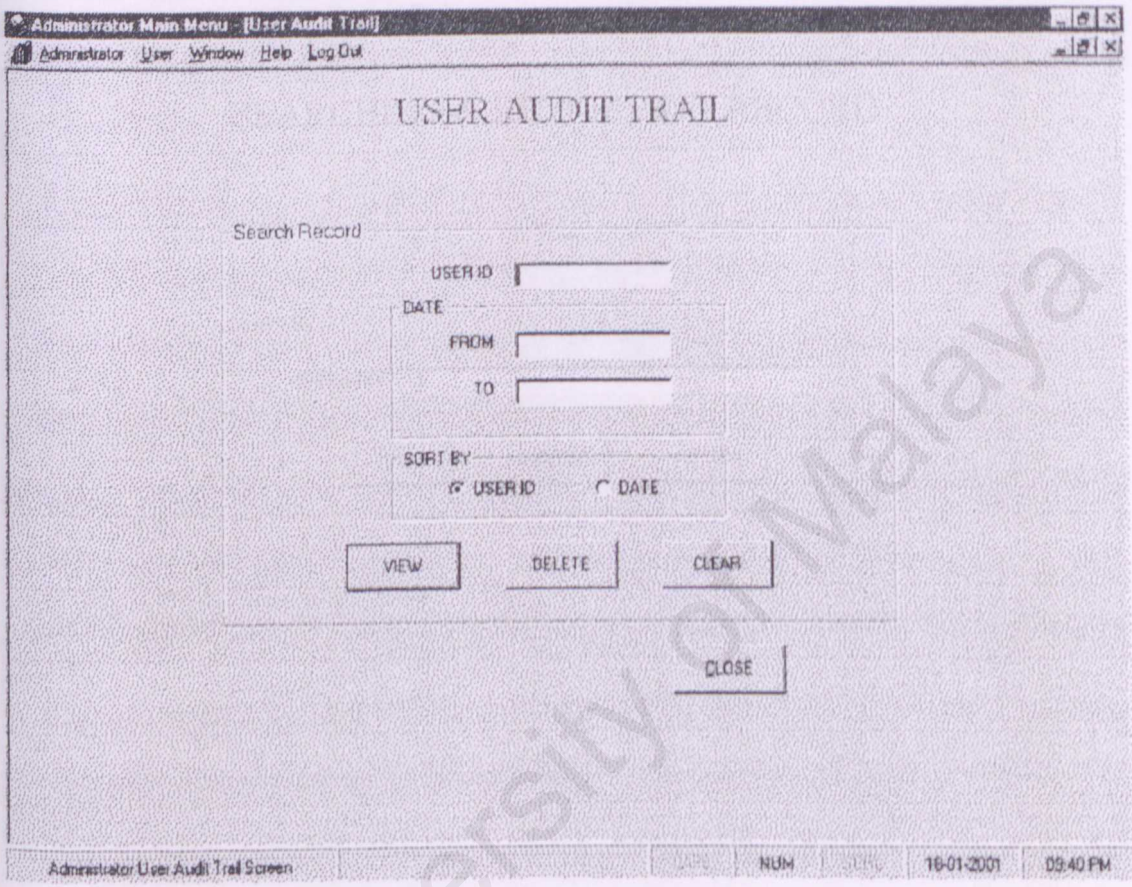
c) Administrator Delete Record Screen



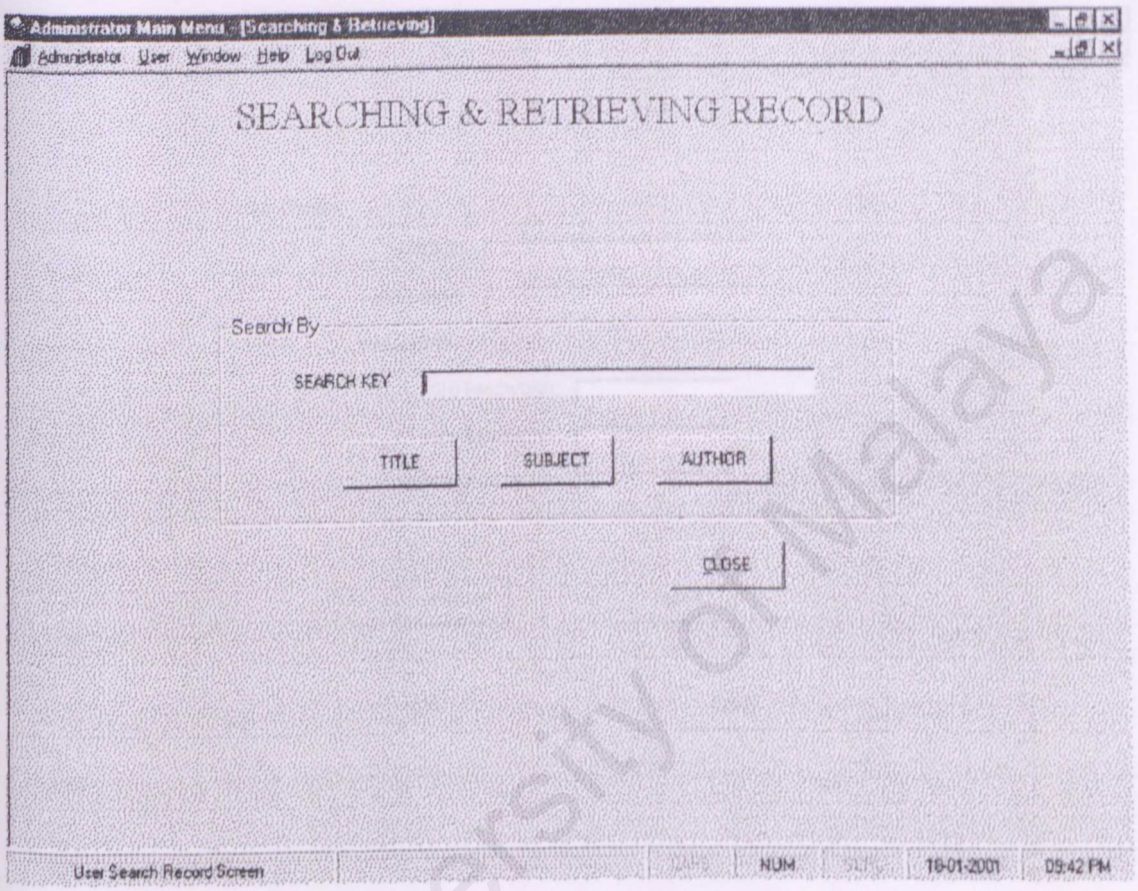
d) Administrator User Setup Screen



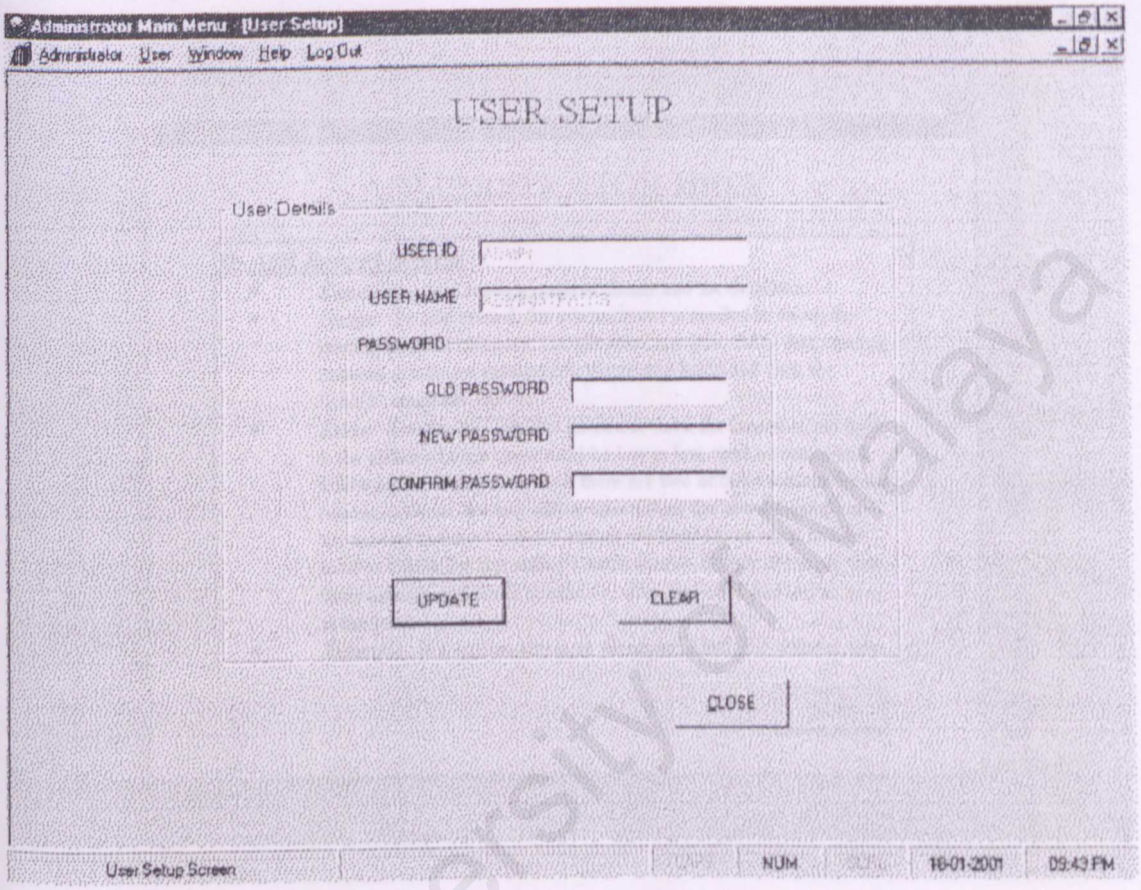
e) Administrator User Audit Trail Screen



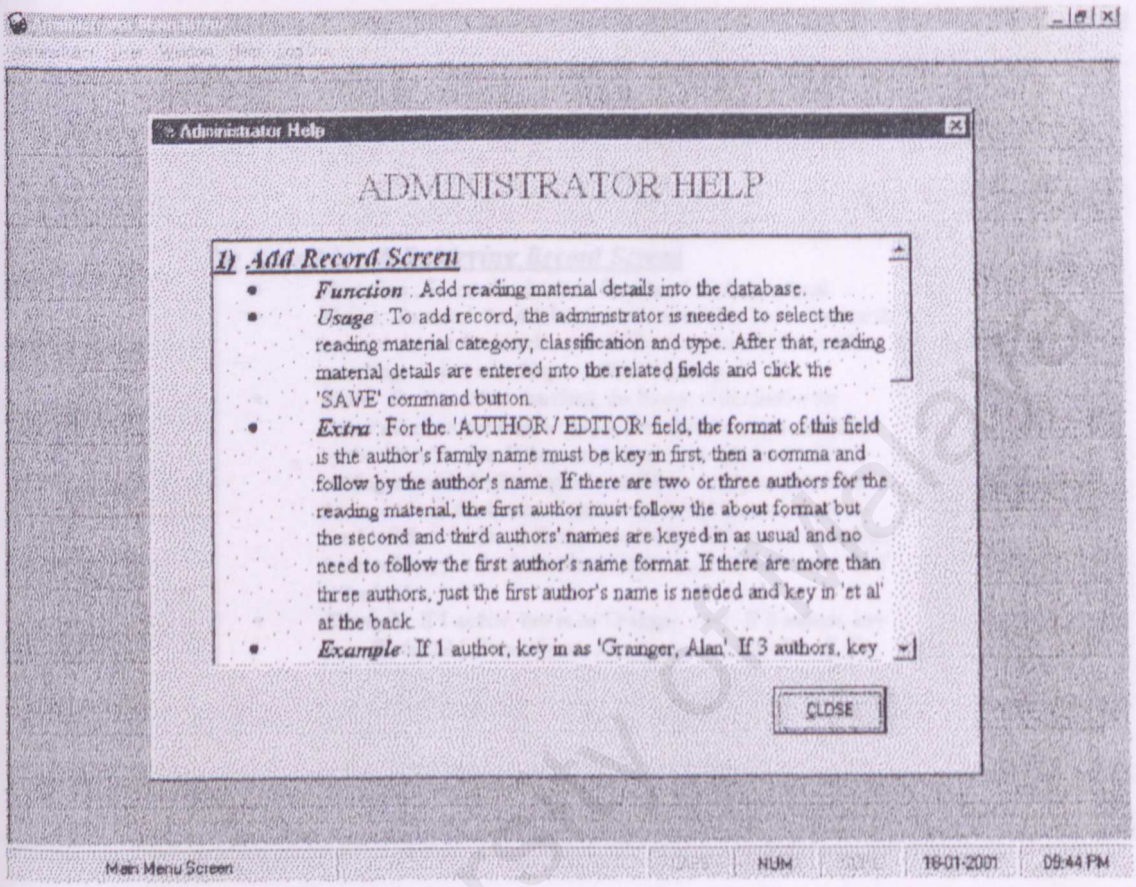
f) User Search Record Screen



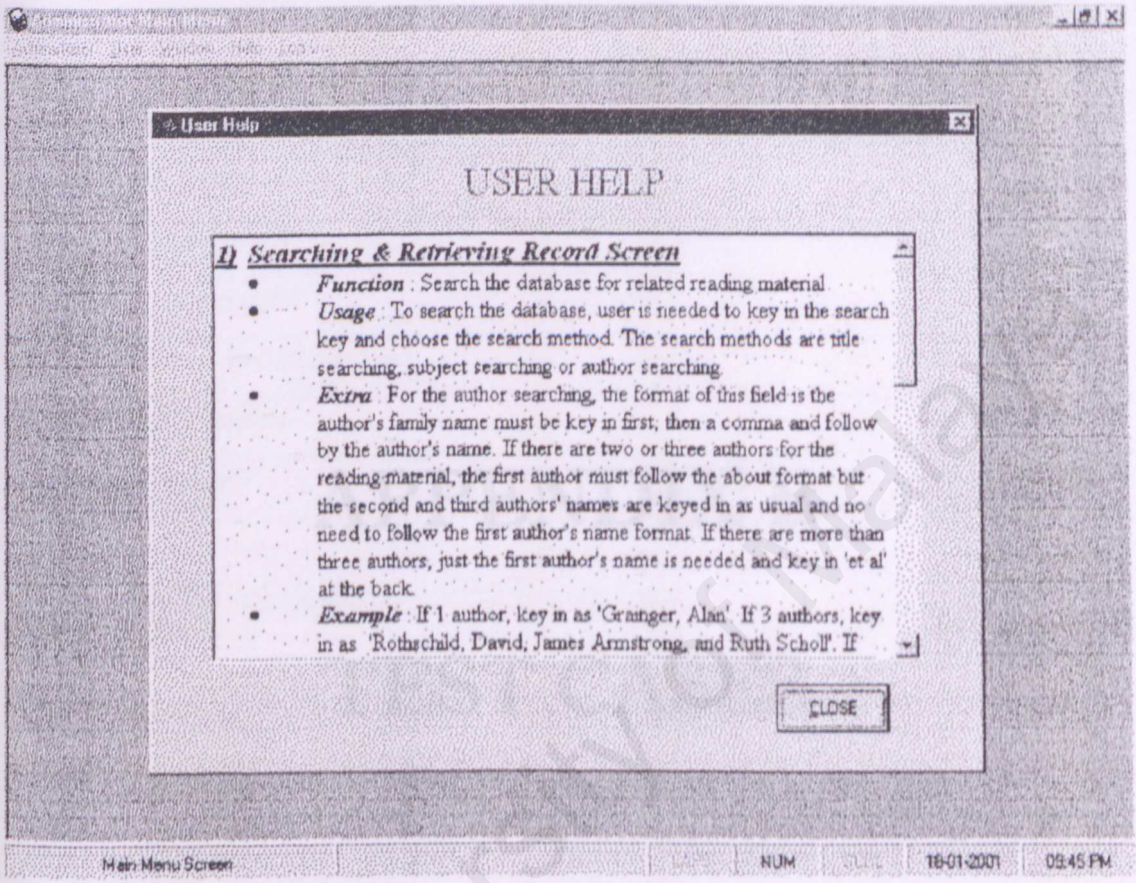
g) User Setup Screen



h) Administrator Help Screen



i) User Help Screen



APPENDIX B

TEST CASES

Appendix B – Test Cases

a) Test case for Administrator Add Record Form

Test	Fault not found	Fault found	Comment
Save book record	*		
Save journal article record	*		
Save magazine record	*		
Save dictionary record	*		
Save CD-Rom / diskette record	*		
Save internet location	*		
Save others record	*		

b) Test case for Administrator Delete Record Form

Test	Fault not found	Fault found	Comment
Search by title	*		
Search by author	*		
Search by title and author	*		
Delete record	*		

c) Test case for Administrator User Setup Form

Test	Fault not found	Fault found	Comment
Add new user	*		
Search existing user	*		
Update existing user details	*		
Delete user	*		

d) Test case for Administrator User Audit Trail Form

Test	Fault not found	Fault found	Comment
Search by user id and sort by user id	*		
Search by date from and sort by user id	*		
Search by date to and sort by user id	*		
Search by a date range and sort by user id	*		
Search by user id and sort by date	*		
Search by date from and sort by date	*		
Search by date to and sort by date	*		
Search by a date range and sort by date	*		
Delete record by user id	*		
Delete record by date from	*		
Delete record by date to	*		
Delete record by a date range	*		

e) Test case for User Search Record Form

Test	Fault not found	Fault found	Comment
Search by title	*		
Search by subject	*		
Search by author	*		

f) Test case for User Setup Form

Test	Fault not found	Fault found	Comment
Update password	*		

APPENDIX C

USER MANUAL

Personal Library & Indexing Management Information System (PLIMIS)

Version 1.0

User Manual

TABLE OF CONTENTS

Abstract

The purpose of this manual is to provide some helpful guideline and usage about this Personal Library & Indexing Management Information System (PLIMIS) to the user. All the installation procedures of this application are explained and can be done by the user.

PLIMIS can be divided into three main modules – Administrator Module, User Module and Help Module.

Administrator has full access rights to the application and can add record, delete record, search record, add new user, update user details, delete user and trace user audit trail. User has limited access to the application and can search record and change user password only.

In the Help Module, administrator and user can view some brief explanations and examples of the functionality in each form.

List of Tables

CHAPTER 1

INTRODUCTION

1.1 PLIMIS

Personal Library & Indexing Management Information System (PLIMIS) is an information system used to manage personal collection of reading materials at home. It also provides a classification and effective indexing method to arrange all the reading materials in a systematic order.

1.2 Hardware & Software Requirements

PLIMIS is specially designed for personal and home use, it can store up to 3,000 records of reading material details. The requirements of this application are :

a) Hardware requirement

i) 486DX/66 MHz or higher processor (Pentium or higher processor recommended), or any Alpha processor running Microsoft Windows NT Workstation.

ii) 16 MB of RAM for Windows 95, 32 MB of RAM for Windows NT Workstation.

iii) At least 30 MB of available disk space.

iv) VGA 800x600 or higher-resolution screen supported by Microsoft Windows.

v) A CD-ROM disc drive.

vi) A mouse or other suitable pointing device.

b) Software requirement

i) Microsoft Windows 95 or later, or Microsoft Windows NT Workstation 4.0 (Service Pack 3 recommended) or later.

CHAPTER II

INSTALLATION

2.1 CD-ROM Installation

The procedures for installing PLIMIS are as follows :

i) Insert the PLIMIS installation CD into the CD-ROM drive.

ii) Execute the setup file name Setup.exe.

iii) To execute this setup file, click the 'Start' menu button on the task bar and then click 'Run'. A window will be displayed and the 'Browse' command button is clicked. Another window will appear and the setup file is selected under the CD-ROM drive path. Highlight the 'Setup.exe' and click 'Open'. The 'OK' command button is clicked if the setup file name and its path is correct.

iv) The setup will provide instryuctions for the installation.

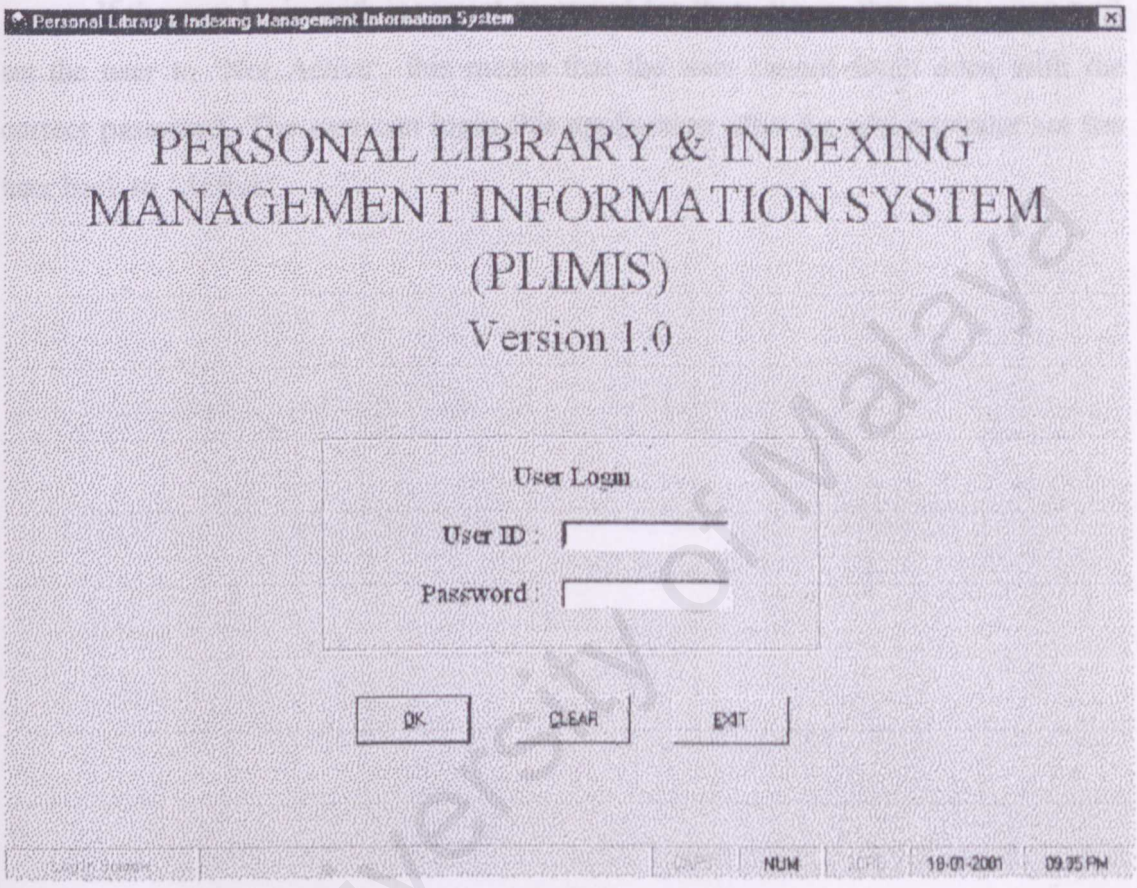
v) After the installation, PLIMIS is ready to be used and in the 'Start' -> 'Programs' -> 'PLIMIS' folder -> 'PLIMIS'.

CHAPTER III

LOGIN

3.1 Security Login

PLIMIS is provided with a security login screen every time the application is started. The fields that are required for the login are 'User ID' and 'User Password'. There are two modes for login, the 'Administrator Mode' and the 'User Mode'.



3.2 Administrator Mode

Administrator has the full access rights to the application. For the first time login, the login id is 'ADMIN' and the login password is '**password**'. There is only one administrator login and the login id is 'ADMIN'. The login id is not allowed to be changed but the login password for the administrator can always be changed.

If the administrator login with incorrect password for three times, this application will not allowed the administrator to login again although the login password is correct. The administrator needs to close the application and start it again to login.

Once the administrator login password is forgotten, reinstallation is needed because there is no way to check the password.

3.3 User Mode

Administrator is needed to add user into the application database. User id and password will be provided to user to login. User has limited access to the application and can search record and change password.

If the user login with incorrect password for three times, this application will set the user to 'Not Active', this means that the user cannot login even with the correct password. The user can login this application after the administrator set the user back to 'Active'.

CHAPTER IV

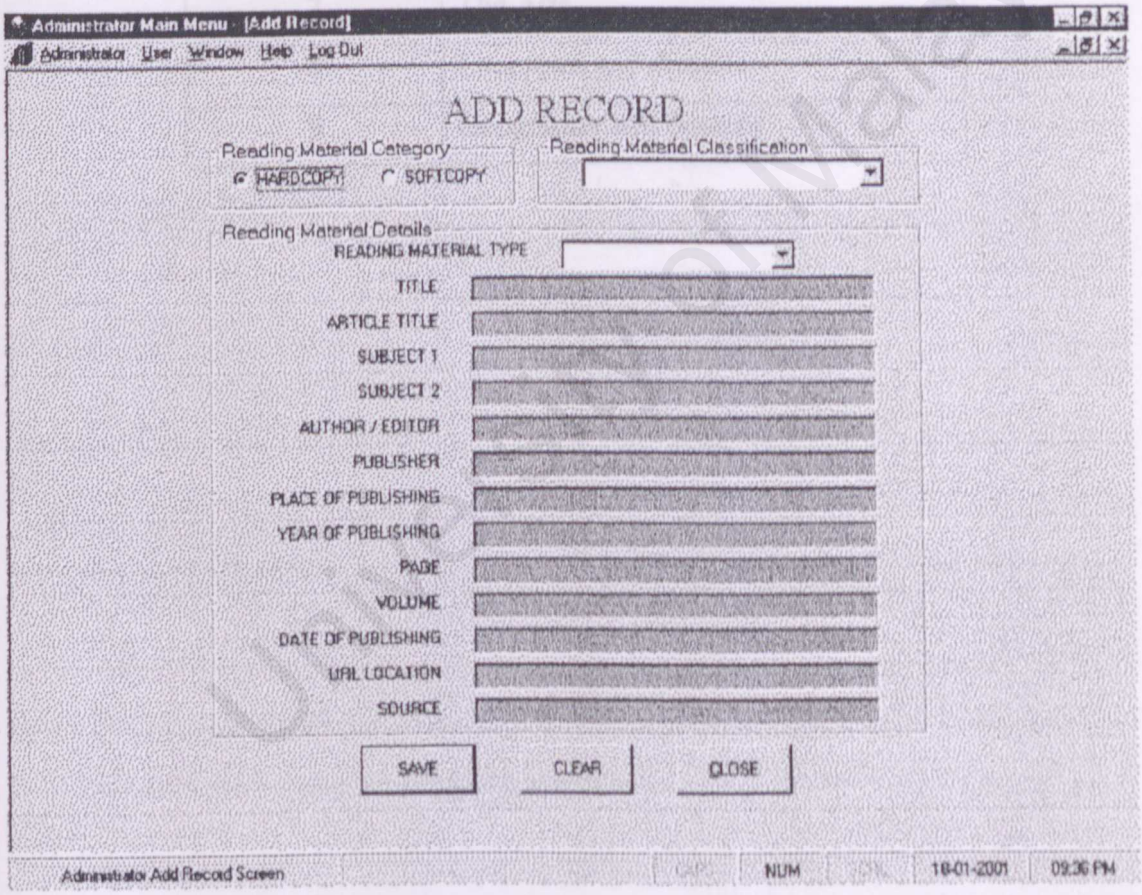
ADMINISTRATOR MODULE

4.1 Administrator Module

There are four forms under the administrator module and their functionality and usage are discussed below :

4.11 Add Record Form

All reading materials are divided into two main categories, hardcopy and softcopy. For classification, Dewey Decimal Classification (DC) is used and ten classes are formed. The administrator needs to select the reading material category, class and type first before entering its details.



After the related fields are filled in, the 'Save' command button is clicked. Message will be displayed if the record is saved successfully.

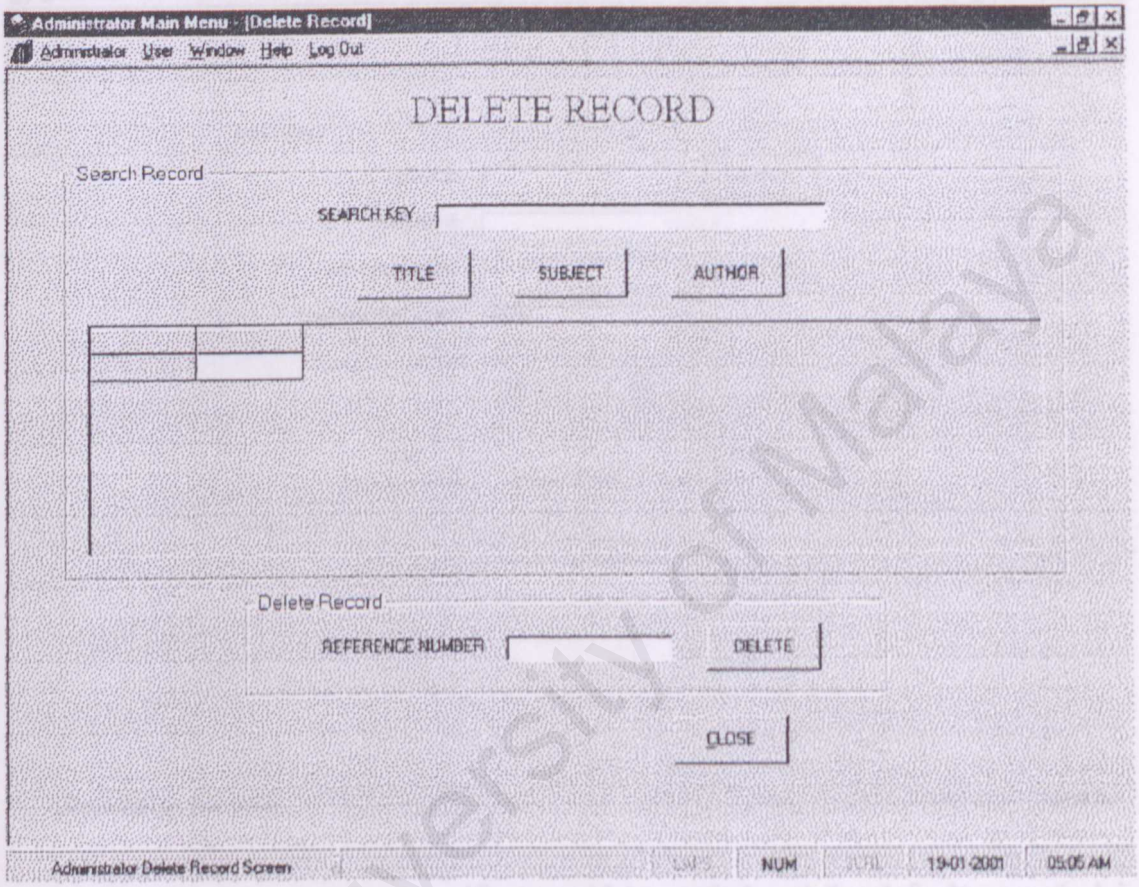
The Dewey Decimal Classification (DC) is outlined as follow :

Table 4.1 Dewey Decimal Classification

0	General works
1	Philosophy and psychology
2	Religion
3	Social sciences
4	Philology
5	Natural sciences and mathematics
6	Technology
7	The Arts
8	Literature and rhetoric
9	Geography and History

4.12 Delete Record Form

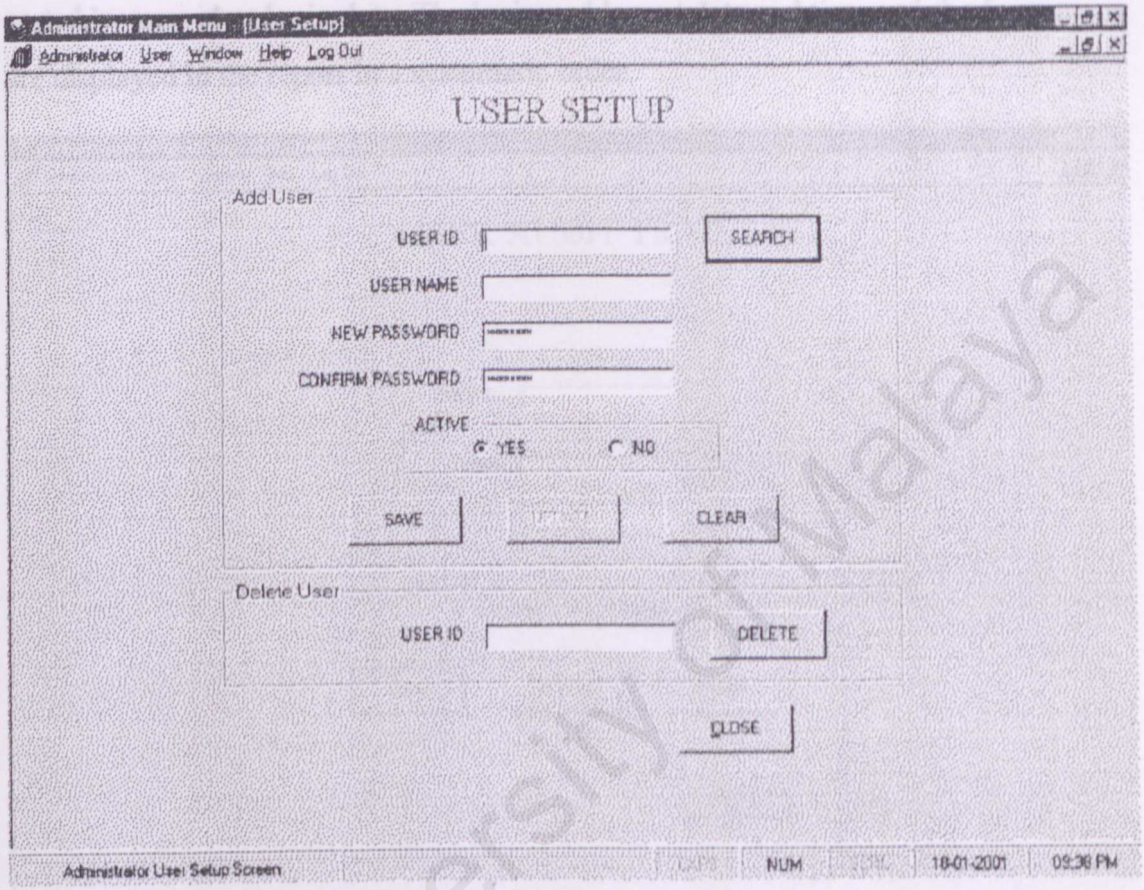
The administrator can delete reading material record from the database. All the records in the database have their own reference numbers. Only the reference number is needed to delete specific record.



The reference number can be found by using the title, subject or author's name searching method. All the related reading material records will be displayed with their reference numbers for the administrator.

4.13 User Setup Form

This form is for the administrator to add new user, update user details and delete existing user.



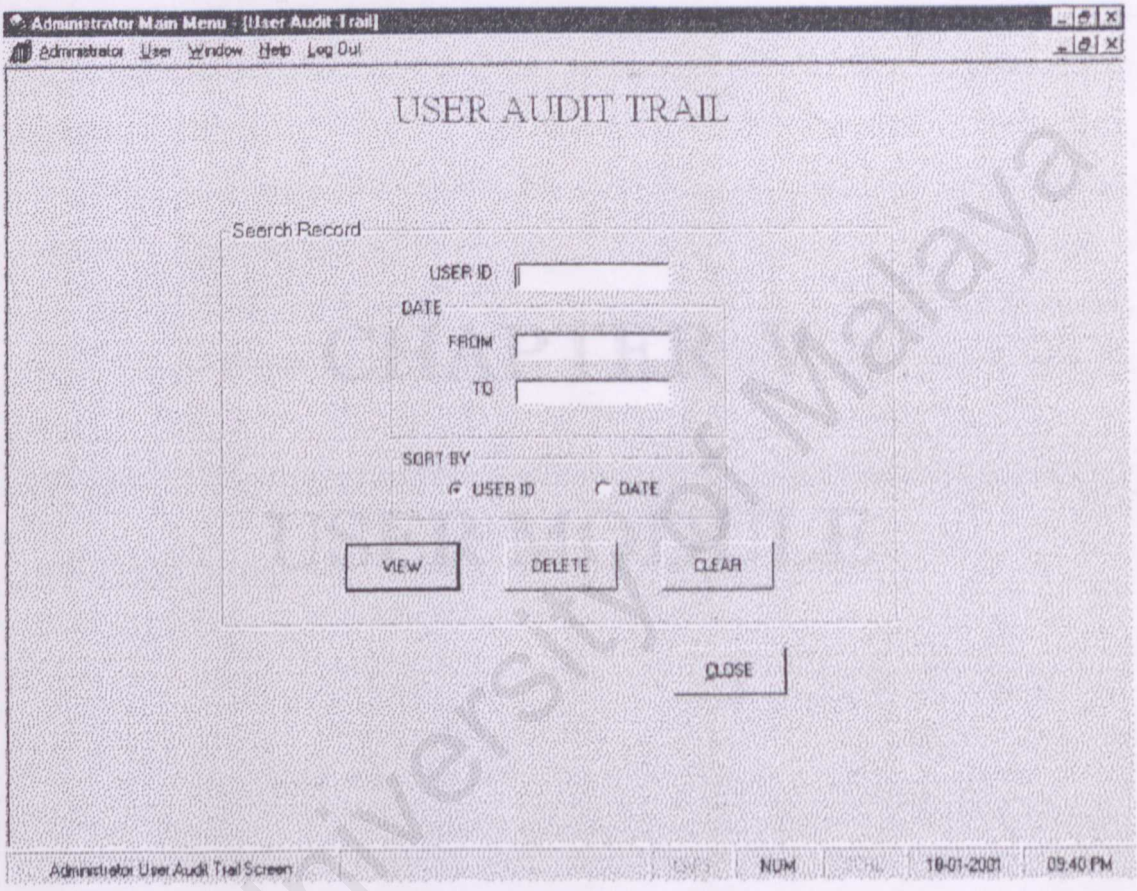
To add a new user, a specific user id is needed and the default password is 'password', which appear in the text boxes. If the user id already exists, message will be prompted to administrator.

To update user details, user id is entered and 'Search' command button is clicked to search the user details in the database. If user exists in the database, details are changed and the 'Update' command button is clicked.

To delete existing user form the database, only user id is needed. Confirm message will be displayed before any deletion is made.

4.14 User Audit Trail Form

Administrator can trace user audit trail by using user id, certain login date, login date range or both user id and login date range. The report which is generated also can be sorted by user id or login date. The login and logout date and time and the form name are displayed in the report in a systematic order.



CHAPTER V

USER MODULE

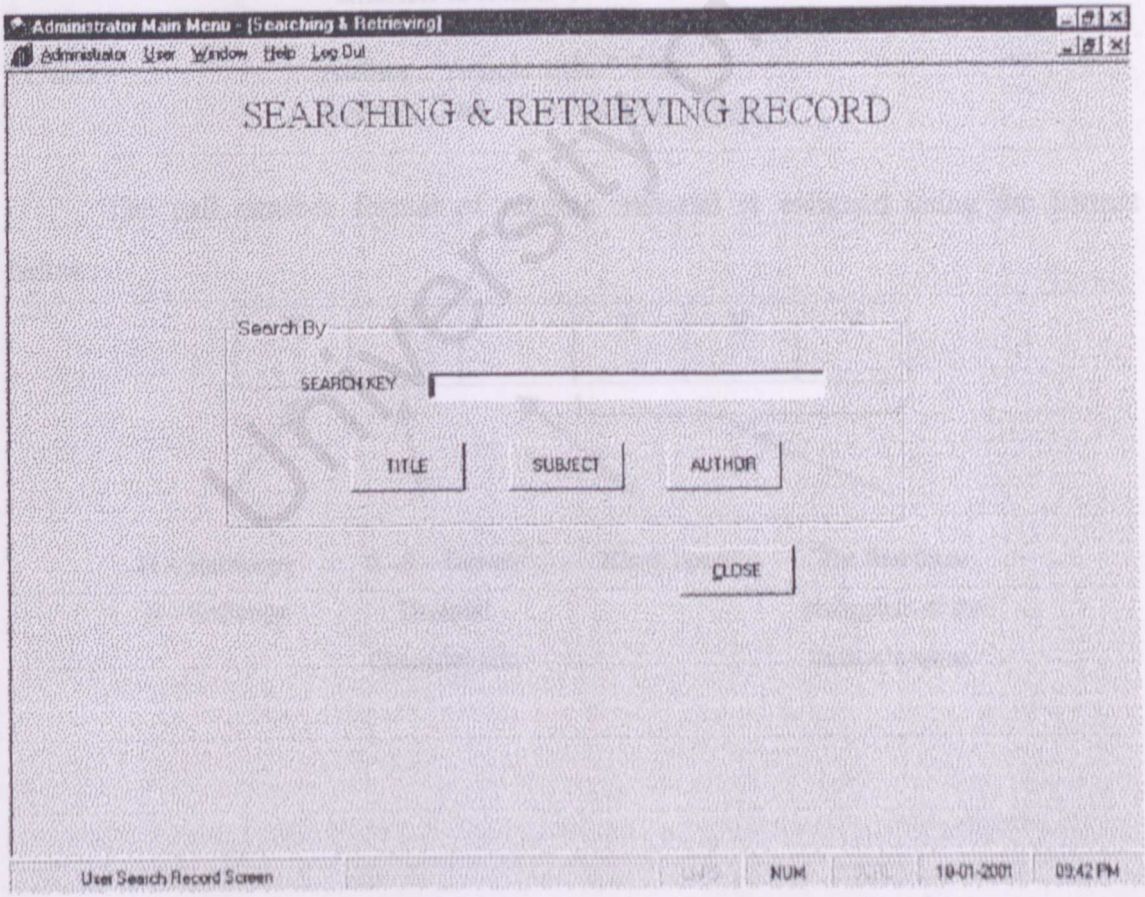
5.1 User Module

There are altogether two forms under the user module and their functionality and usage are discussed below :

5.11 Search Record Form

User can search the database for certain records by using title, subject or author's name searching method. All the search results will be generated in a report and displayed for the user.

Title searching is to search the title of reading material, which exactly matches the title that entered by the user. For subject searching, user is required to enter the keyword, and relevant reading material with the keyword will be found. Author's name searching is to find the reading material with the specific author's name.



The search results formats follow the Modern Language Association of America (MLA) style, as shown below :

- *Book* : Author. Title.
  Place of publishing : Publisher, Year of publishing.

- *Journal Article* : Author. "Article title." Journal title Volume.
  (Year of publishing) : Page.

- *Magazine* : Title, Volume.
  Date of publishing.

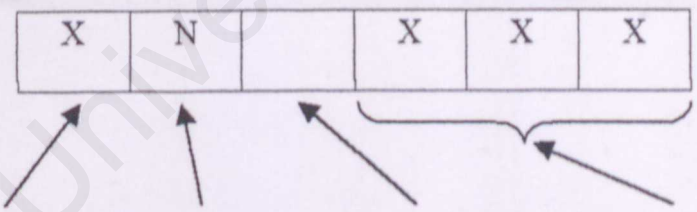
- *Dictionary* : Title.
  Place of publishing : Publisher, Year of publishing.

- *CD-Rom / Diskette* : Author. Title.
  Publisher, Year of publishing.

- *Internet Location* : Title. Date of publishing.
  <Internet location>.

- *Others* : Author. "Article title." Title.
  Source, Date of publishing : Page.

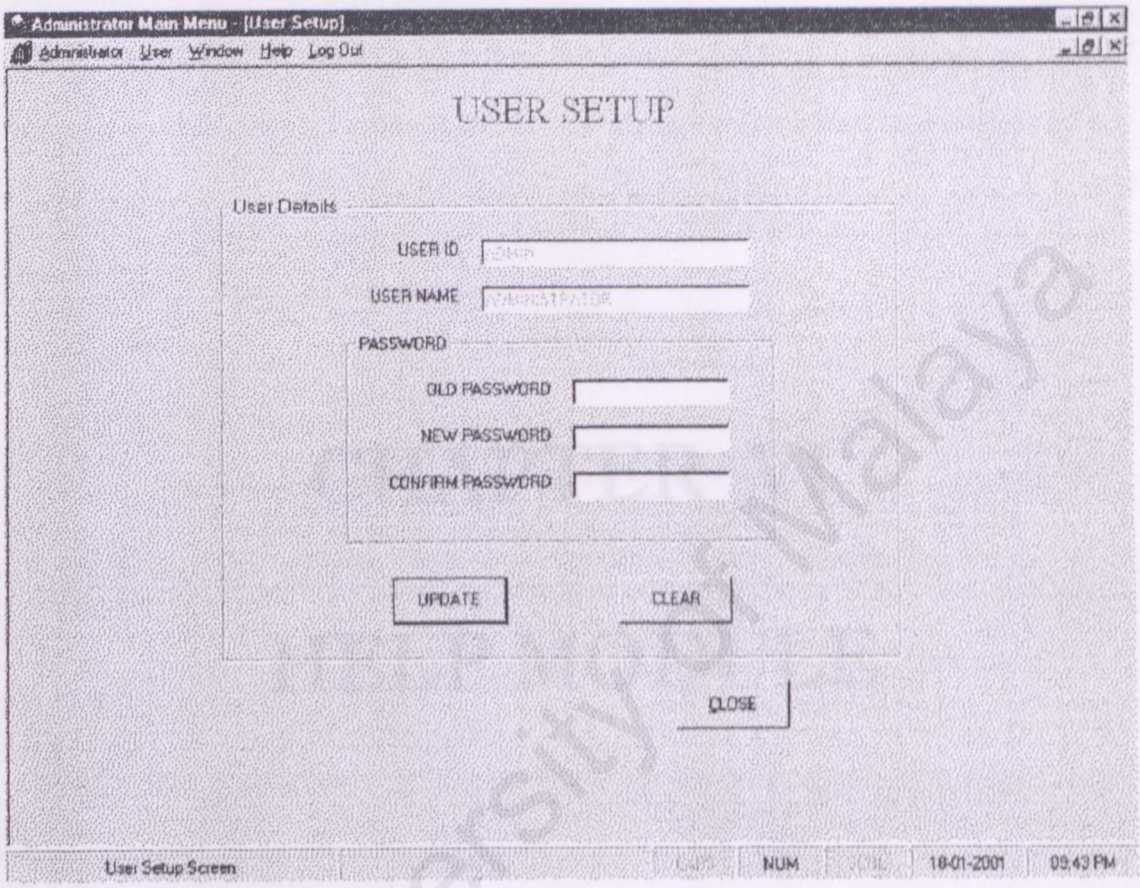
The call number format of reading material is assigned using the format below :



H – Hardcopy S – Softcopy	0 - 9 – Dewey Decimal Classification	Blank Space	The first three characters of the author's name.

5.12 User Setup Form

User can change password by using this form. Old password, new password and confirm password are the needed fields to change password.

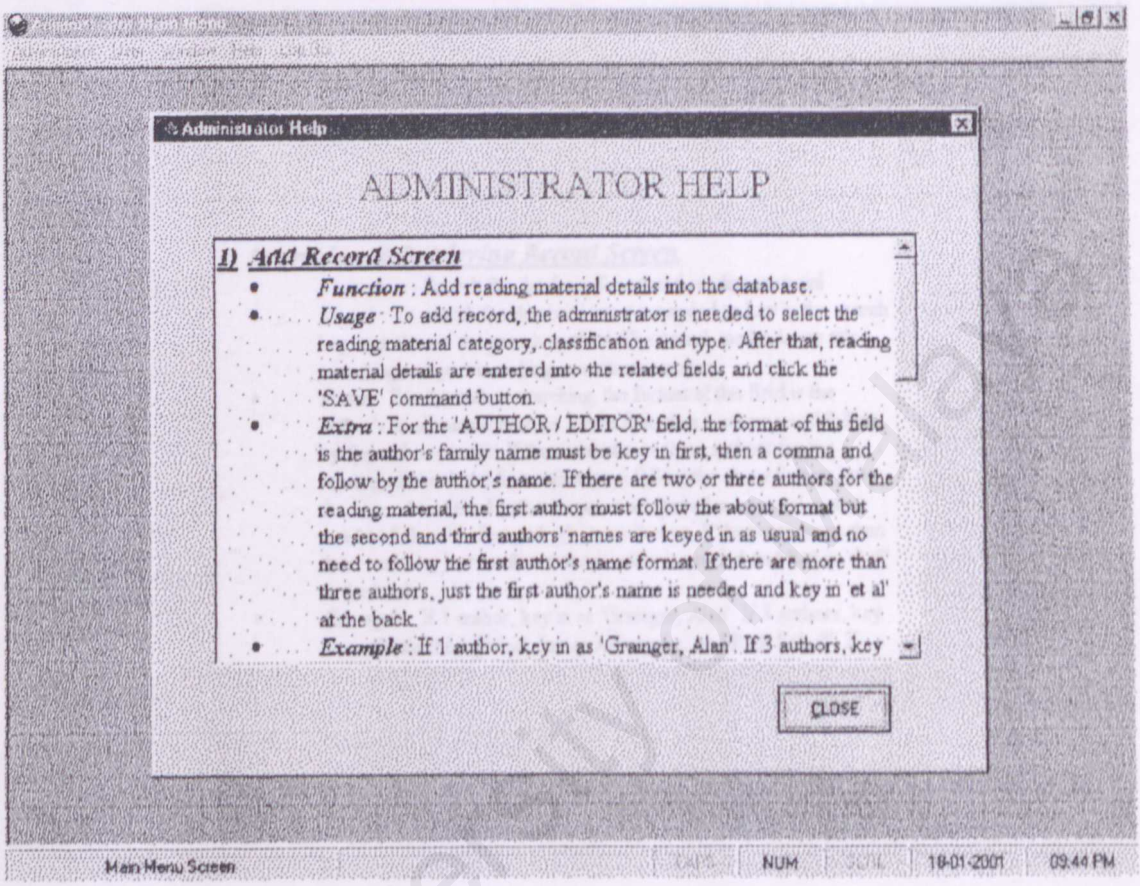


CHAPTER VI

HELP MODULE

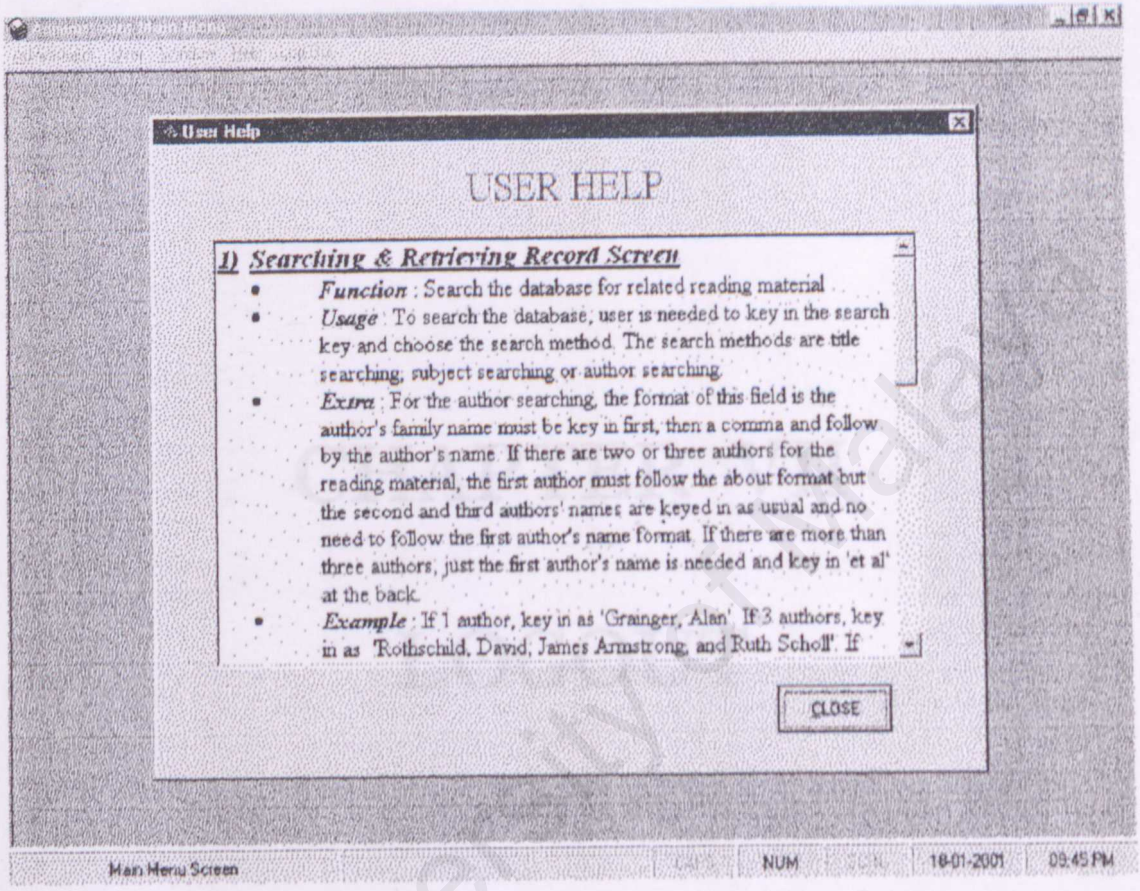
6.1 Administrator Help Form

This form contains brief explanations and examples of each form in the Administrator Module.



6.2 User Help Form

This form contains brief explanations and examples of each form in the User Module.



CHAPTER VII

LOGOUT

7.1 Logout

Logout is needed to prevent unauthorized user to use this application. User can click the 'Logout' button at the menu bar or click the 'x' (close) button on the top of right hand side to close the application.